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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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83 ECONOMICS AND COST ANALYSIS 2608
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2608
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) 2612

89 ASTRONOMY 2612
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2613
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2614
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 2615
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2616
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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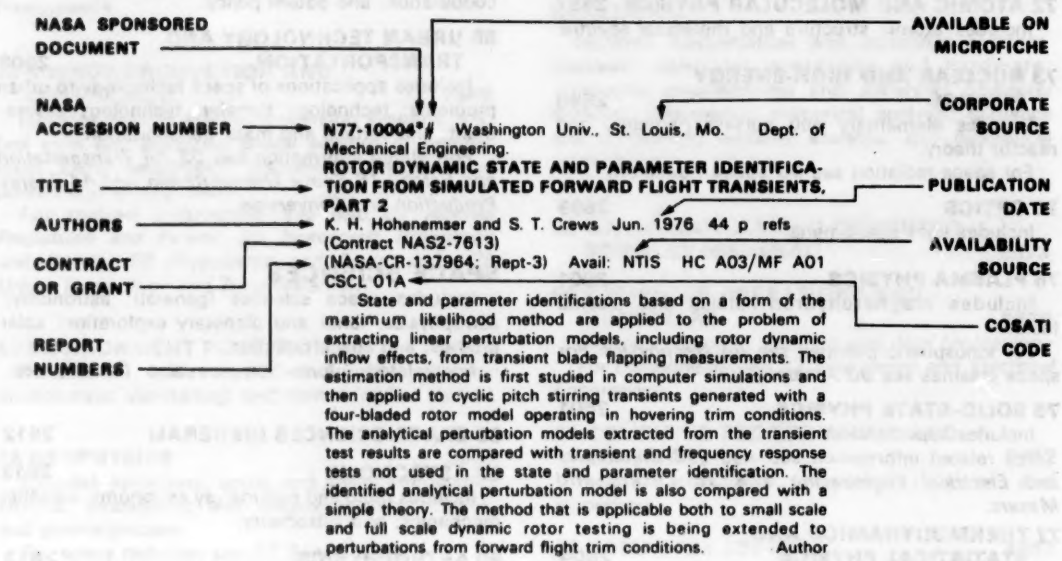
TYPICAL CITATION AND ABSTRACT


NASA SPONSORED DOCUMENT
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NASA ACCESSION NUMBER
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N77-10004*# Washington Univ., St. Louis, Mo. Dept. of Mechanical Engineering.
TITLE
ROTOR DYNAMIC STATE AND PARAMETER IDENTIFICATION FROM SIMULATED FORWARD FLIGHT TRANSIENTS, PART 2
PUBLICATION DATE
AUTHORS
K. H. Hohenemser and S. T. Crews Jun. 1976 44 p refs
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(NASA-CR-137964; Rept-3) Avail: NTIS HC A03/MF A01
CSCL 01A
COSATI CODE
State and parameter identifications based on a form of the maximum likelihood method are applied to the problem of extracting linear perturbation models, including rotor dynamic inflow effects, from transient blade flapping measurements. The estimation method is first studied in computer simulations and then applied to cyclic pitch stirring transients generated with a four-bladed rotor model operating in hovering trim conditions. The analytical perturbation models extracted from the transient test results are compared with transient and frequency response tests not used in the state and parameter identification. The identified analytical perturbation model is also compared with a simple theory. The method that is applicable both to small scale and full scale dynamic rotor testing is being extended to perturbations from forward flight trim conditions. Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects – not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, DESIGN IMPROVEMENT FOR ICE-PROTECTED UH-1H ROTOR BLADES

J. GEORGE, Lockheed California Company, *Burbank, California* 91503 (DA0D4064; DAAJ02-76-C-0041)

Based on failure analyses made and deficiencies identified under contract DAAJ02-76-C-0012, design an improved UH-1H main rotor blade deicer boot and begin fabrication.

To reduce occurrence of electrical shorts to erosion shield, a thicker dielectric will be used. Heater coverage will be expanded and external contour improved. Stricter quality control will be used to insure better bonding and reduce voids in the heater blankets.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R D Lab, Eustis Dir, Ft Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense, Army

1.0002, DESIGN CRITERIA FOR APPLICATION OF MEMBRANE NITROGEN INERTING SYSTEMS TO ARMY AIRCRAFT FUEL TANKS

S.A. MANATT, Signal Companies Incorporated, *Torrance, California* 90509 (DA0D4079; DAAJ02-76-C-0073)

To analytically examine the feasibility of using membrane nitrogen inerting technology to reduce the ullage vulnerability of Army aircraft and to generate preliminary designs for membrane nitrogen inerting systems for the AH-1, CH-47 and OV-1 aircraft.

An analytical estimate of the nitrogen inerting system design requirements and physical parameters will be made for several helicopter systems and missions. Overall relationships between system penalties, configurations, and mission parameters will be obtained. Preliminary designs, including system size, weight, locations, aircraft interface and performance will be accomplished for three Army aircraft. A flightworthy design will be generated for the AH-1G helicopter. A system suitable for laboratory demonstration and experimental evaluation will be designed and fabricated.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R D Lab, Eustis Dir, Ft Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense, Army

1.0003, STRUCTURAL INTEGRITY OF STORES AND STORE-AIRCRAFT INTERFACES

C.W. INGRAM, U.S. Air Force, Armament Test Laboratory, *Eglin Air Force Base, Florida* 32542 (DF626600)

To develop the in-house capability of performing structural analysis on stores, racks, and/or aircraft interface. The results of this work unit should include a quick-look capability utilizing classical techniques for assessing structural adequacy of munitions and evaluating proposed design changes and a finite element capability for investigating larger structures for design or redesign evaluations.

In order to facilitate ready application of all techniques developed, computer programs will be obtained or generated to perform the needed operations. For the 'quick-look' capability, this implies that a series of small specialized programs will be generated for specialized tasks. Those programs shall be programmed to minimize run time and input complexity. For the finite element capability, several programs will probably be needed, depending on the complexity of the model desired. In this manner, run time, and thus cost, can be minimized for a particular application.

ADDENDA: Supporting agency address is: AF Armament Laboratory DLJC, Eglin AFB, Fla 32542

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0004, IMPROVED PROCESS FOR PREPARING 3-FLUOROSALICYLALDEHYDE

M. MARTIN, Univ. Oil Products Company, *Des Plaines, Illinois* 60016 (DF134080; F33615-76-C-3052)

An on-board oxygen generating system is being developed for use in military aircraft. This system uses a chemical, common name fluomine, which concentrates oxygen from air to supply the aviator's breathing requirements. Unfortunately, the cost of this chemical makes this system uneconomical when compared to conventional oxygen supply methods. The high cost for fluomine is mainly due to the high cost of 3-fluorosalicylaldehyde, a material used in fluomine preparation which constitutes the bulk of fluomine. It is the objective of this program to reduce the cost of 3-fluorosalicylaldehyde by improving the process by which it is produced. The results should allow development of an oxygen system at reasonable cost and thereby exploit the inherent advantages of an on-board oxygen generator.

The current process for producing 3-fluorosalicylaldehyde shall be perused in order to optimize its production efficiency. In addition, two additional routes which offer the potential for cost savings shall be investigated. The best performer of these three processes shall then be subjected to scale-up studies appropriate for production rates of about 5000 lb. per year.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FEE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0005, BALLISTICS TECHNOLOGY - AIRCRAFT ARMAMENT SYSTEMS AND SURVIVABILITY

D.F. HASKELL, U.S. Army, Ballistic Modeling Division, *Aberdeen Proving Ground, Maryland* 21005 (DA0P4450)

To develop an Army aircraft armament system analysis model (AASAM) and techniques for increased survivability of Army aircraft.

A helicopter armament system engineering model will be developed. This model will be composed of an integrated set of submodels and will be capable of evaluating armament systems effectiveness. It will tie together weapon interior, exterior, and terminal ballistics with fire control, aircraft flight control, aircraft structural dynamics response, and armament system lethality. Means to increase helicopter survivability will be studied. The effect of future composite materials on helicopter structural vulnerability reduction will be assessed. A truss-type helicopter tail boom will be designed, fabricated, and tested. In addition, a technique for the optimum design of helicopter structures for vulnerability reduction will be developed.

ADDENDA: Supporting agency address is: DARCOM Ballistic Research Laboratories, Aberdeen PG, MD 21005

SUPPORTED BY U.S. Dept. of Defense, Army

1.0006, FABRICATION OF EXPERIMENTAL PLUME IR SUPPRESSION SYSTEM - ARMY AIRCRAFT

T. CHEW, General Electric Company, *Lynn, Massachusetts* 01910 (DA0D4072; DAAJ02-76-C-0063)

Fabrication of the experimental plume suppression system developed and designed under previous efforts (contracts 73-C-0048 and 75-C-0027) for AMRDL performance evaluation and countermeasure effectiveness.

Fabricate and fit-check flight-weight hardware from the design developed under previous contract. This design incorporates into one suppression system the latest plume suppression technology with hot parts suppression technology. Support flight performance and suppression evaluation to be conducted by AMRDL.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R D Lab, Eustis Dir, Ft Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense, Army

1.0007, EFFECTS OF HORIZONTAL FIBER LAYERS IN PAVEMENT SYSTEMS

G.M. HAMMITT, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (DA0X8180)

To determine the reinforcing effect of thin horizontally oriented fiber cloth and fiber membrane layers placed between normal pavement layers or between the pavement structure and subgrade of various military road and airfield pavement systems.

Document through field performance surveys and design data reviews recent qualitative engineering reports of pavement performance benefits derived from internal placement of horizontal fiber cloth layers in flexible pavement sections. Explore and isolate primary reasons for improved performance through analysis and component laboratory and field tests - filtering action, pore water pressure dissipation and resistance to horizontal torsional forces will be investigated. If successful in validating and quantifying the improved performance, follow-on efforts to develop design and construction criteria will be initiated.

ADDENDA: Supporting agency address is: OCE Army Engineer, Waterways Experiment Station, P O Box 631, Vicksburg, MS 39180

SUPPORTED BY U.S. Dept. of Defense, Army

1.0008, TERRAIN ANALYSIS FOR HELICOPTER OPERATIONS

J.K. STOLL, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (DA0A8015)

To develop analytical procedures for evaluating terrain influences on helicopter survivability in flight and in the attack mode, and opportunity for engagement of selected targets.

To develop a general procedure that relates the physical and operational characteristics of helicopters to ground elevation and vegetation. Computer programs will be written to simulate helicopter operations, concentrating on helicopter flight across the terrain both in search patterns and in flights to specified objectives, and on helicopter altitude for attack. The object will be to simulate vulnerability of helicopters to direct-fire ground-based weapons systems while moving cross country or positioning for attack, and to study the influence of the terrain on that vulnerability. The results of such simulations will be the ability to (a) study flight paths and altitudes with least exposure to a specific ground-based weapon system (weapon system capabilities included in simulation); (b) compare evasive maneuvers as to time helicopters remain within the weapon coverage region after a helicopter is brought under fire (weapon system, helicopter maneuver capability, and terrain included in simulation); (c) compare the effect of maneuver capabilities of selected helicopters (proposed utility tactical transport aircraft system and new advanced attack helicopters on the time a helicopter remains within the ground weapon coverage region; and (d) study the effect of helicopter altitude on area covered by fire and area from which the helicopter is open to fire when in an attack position (e.g., in position to deliver tow fire against enemy vehicles).

ADDENDA: Supporting agency address is: OCE Waterways Experiment Station, PO Box 631, Vicksburg, MS 39180

SUPPORTED BY U.S. Dept. of Defense, Army

1.0009, FLIGHT DECK CONTROL WORK STATION

M. KOLODNER, U.S. Navy, Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN796001)

A study will be made to improve the safety and efficiency of carrier aircraft handling operation by improving the capability and performance of aircraft handling officer (ACHO). Recommendations will be made for the design of equipments, controls, and displays and their arrangement and location within FDC.

It is planned to secure services of Human Factors Research, Inc. (HFR) who are expert in making studies of various work stations throughout carriers such as LSO, PRI-FLY, and CATCC.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense, Navy

1.0010, AERODYNAMIC PROPERTIES OF EJECTING CREWMAN

B.J. WHITE, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF140240)

To increase the probability of crew member survivability during in-flight emergencies through providing more effective emergency escape subsystems. Solutions will be identified for the current operational problem of a high incidence of aircrew injuries due to limb flailing. Aerodynamic forces acting on the crewman during ejection from aircraft flying at transonic and supersonic speeds will be determined. Design criteria will be established to form a basis for concept assessment and equipment designs to provide crew protection during emergency escape from high-speed combat aircraft.

High-speed wind-tunnel tests will be conducted using special seat/man models to provide limb flail force as well as basic aerodynamic data. Existing limb restraint concepts and hardware will be assessed and concepts formulated to provide a solution to the limb flail injury problem. The effort will be accomplished jointly with the 6750th Aerospace Medical Research Laboratory.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FER, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0011, REVERSE VELOCITY ROTOR CONCEPT

H.N. STUVERUDE, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DN590188; N00019-76-C-0436)

To assess the reverse velocity rotor (RVR) configuration and advanced rotary concept, against the projected Navy/Marine Corps requirement for replacement of the current SH-3 and CH-46 medium assault helicopters. Technology levels will be consistent with an initial operating capability (IOC) date between 1981 and 1984.

Using the government-furnished data base generated under Navy contract N00019-75-C-0522, the contractor will design an RVR high-speed helicopter. Sensitivity of the vehicle designs to variations of the primary inputs to the design study will be explored. The contractor will also assess the risk of improving those inputs which hold the most promise for a lighter gross weight.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense, Navy

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, COMPILATION OF STABILITY FIELD DIAGRAMS FOR STRUCTURAL STEELS IN MULTICOMPONENT GASES
I. FINNIE, Univ. of California, School of Engineering, *Berkeley, California* 94720 (NCA 2-50706)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

3.0002, LASER-INDUCED COHERENT INTERACTIONS
T.K. GUSTAFSON, Univ. of California, School of Engineering, *Berkeley, California* 94720 (NCA 2-50707)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

3.0003, ELECTRONIC STATES OF CONJUGATED MOLECULES AND OPTICAL PROPERTIES OF POLYMERS AND FLUIDS
R.A. HARRIS, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (CHE75-09422 A02)

Dr. Harris intends to carry out a research program consisting of the following two parts: (1) The Electronic States of Conjugated Molecules. (A) 'Exact' and approximate calculation of the properties of certain pi-electron systems. (B) The theory of the optical properties of nonbonding electrons in conjugated molecules. (C) The theory of nonlinear optical properties of large molecules. (2) The Optical Properties of Polymers and Fluids. (D) Light scattering from polymers and fluids. (E) 'Ab Initio' calculation of many-body polarizabilities, and other susceptibilities, in atomic and molecular fluids.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

3.0004, FREE RADICAL KINETICS BY PHOTOIONIZATION
K.D. BAYES, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (CHE74-18646 A01)

A photoionization mass spectrometer, developed at UCLA for detecting free radicals, will be combined with a flash photolysis apparatus to monitor gas phase free radical concentrations as a function of time in controlled combustion reactions. Combining the logarithmic decay time of the free radical signal with the known partial pressures of reactants will give absolute rate constants of the reactions they undergo. The photoionization mass spectrometer will also be used to monitor the appearance of products, both free radicals and stable molecules. The temperature and pressure dependence of the rates and mechanisms will be investigated. Free radical systems that will be studied will include: 1. Reaction of alkyl radicals with molecular oxygen; 2. Oxidation of NO to NO2 by alkylperoxy radicals; 3. Reaction of OH and alkyl radicals with O2 and other atmospheric species, and the subsequent reactions which occur; 4. Reactions of alkoxy radicals with atmospheric species.

Rate constants and mechanisms of these reactions are needed for modelling studies of the stratosphere and the polluted troposphere. This work is a continuation of that currently supported by Foundation grant, CHE 7418646.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

3.0005, COMPRESSIBILITY MEASUREMENTS
G.C. KENNEDY, Univ. of California, Inst. of Geophys. & Pla. Phys., *Los Angeles, California* 90024 (EY-76-S-03-0034 171)

We developed techniques for the direct measurement of Gruneisen's gamma as a function of compression and note that for liquids, gamma steadily increases as a function of compression whereas for all metals gamma decreases at an apparently uniform rate. We interpret the behavior of gamma as a result of change in thermal expansion as a function of compression. Therefore, we propose to directly measure the thermal expansion at high pressures and as a function of pressure. To the best of our knowledge, no measurements of thermal expansion have been done since the early work of P.W. Bridgman some 15 years ago.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

3.0006, PREPARATION OF THERMALLY STABLE DRY CHEMICALS
A.C. LING, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NSG 2223)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

3.0007, HOT SURFACE IGNITION TEMPERATURE OF AIRCRAFT HYDRAULIC FLUIDS
D.J. MYRONUK, Calif. State Univ. & Colleges, School of Engineering, *San Jose, California* 95114 (NSG 2219)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

3.0008, AN INVESTIGATION OF THE KINETICS FOR HYDROGEN CHEMISORPTION ON IRON METAL SURFACES
M.R. SHANABARGER, Univ. of California, Graduate School, *Santa Barbara, California* 93106 (NSG 2222)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

3.0009, ENVIRONMENTAL DURABILITY OF FIBER-REINFORCED COMPOSITES 14414-MS
D.H. KAELBLE, Rockwell International Corp., *Thousand Oaks, California* 91320 (DA0E9297; DAAG29 77 C 0005)

To determine the physiochemical mechanisms of environmental durability and degradation of graphite-epoxy and fiberglass-epoxy composites under hydrothermal (high moisture and temperature) exposure. Relevance - the research is directly relevant to the degradation of the structure and properties of epoxy matrix composites, which are being used (or considered for use) in many Army components, e.g., aircraft, portable bridges, missile launch tubes and motor cases, tank wheels.

Determine the effects of moisture and temperature on the composition and bonding of the fiber-matrix interface; evaluation loss of bonding at the fiber-matrix interface by measurement of interlaminar shear strength; and determine the effects of moisture and temperature upon the bulk properties of the matrix epoxy, e.g., composition, adhesive aspects, and rheology.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense, Army

3.0010, FRACTURE AND FATIGUE CHARACTERIZATION OF AIRCRAFT STRUCTURAL MATERIALS UNDER BIAXIAL LOADING
D. JONES, George Washington University, Graduate School, *Washington, District of Columbia* 20006 (DF045860; AFAFOSR-3099-76)

AF function - to contribute to a better understanding of fatigue and fracture processes for structural materials so that their life-cycle serviceability might be optimized. In this manner, Air Force flight vehicles can, ultimately, be much improved. Deficiency - a better understanding about flaws and their associated effects under biaxial loading will allow designers to consistently improve flight worthiness. Objective - this research program is given to the problem of understanding the effect of biaxial loads on cracked metal specimens. How work contributes - better knowledge about the behavior of structural materials under biaxial stress conditions should serve to improve Air Force flight systems and their components.

The primary emphasis of the analytical research effort will be to formulate the proper foundation for fracture mechanics applications under biaxial applied loads. The experimental portion will emphasize the determination of the effects of biaxial applied loads on the fracture toughness and on fatigue crack growth rates.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0011, STATISTICAL CHARACTERIZATIONS OF THE FATIGUE BEHAVIOR OF COMPOSITE LAMINA
J.N. YANG, George Washington University, Graduate School, *Washington, District of Columbia* 20006 (NSG 1415)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

3.0012, RESEARCH IN ENVIRONMENTAL EFFECTS ON ADVANCED COMPOSITES IN THE JOINT INSTITUTE FOR ADVANCEMENT OF FLIGHT SCIENCES (ABBREV)
H. LIEBOWITZ, Howard University, Graduate School, *Washington, District of Columbia* 20001 (NSG 1418)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

3.0013, TOXIC CHEMICAL WASTE DISPOSAL
UNKNOWN, Florida Inst. of Technology, Graduate School, *Melbourne, Florida* 32901 (NAS10-9166)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

3.0014, EFFECTS OF DEBRIS DENTS AND FURROWS ON ELASTOHYDRODYNAMIC LUBRICATION
H.S. CHENG, Northwestern University, School of Technology, *Evanston, Illinois* 60201 (NSG 3149)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

3.0015, ROLE OF DEFECTS IN PHASE TRANSFORMATION IN LAVES PHASES & RARE EARTH-COBALT INTERMETALLICS
C.W. ALLEN, Univ. of Notre Dame, School of Engineering, *Notre Dame, Indiana* 46556 (DMR76-23188)

This is a continuation of research on the role of planar defects and dislocations in the formation of shear structures and in shear transformation of layer structure Laves phases and rare earth cobalt intermetallic compounds. Transmission electron microscopy is employed to determine the structures of a series of compounds formed with rare earth (RE) elements and cobalt (Co), including those with approximate RE to Co ratios of 1 to 2, 1 to 3, 2 to 7, 1 to 5 and 2 to 17. In addition, the details of structural transformations of these materials during heating and cooling will be determined. This is a renewal of NSF Grant DMR74-02523.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0016, SYNTHETIC AND MECHANISTIC STUDIES IN FLUORINE CHEMISTRY
D.D. DESMARTEAU, Kansas State University, School of Arts & Sciences, *Manhattan, Kansas* 66506 (DA0F8931; DAAG29 77 G0071)

To explore the chemistry of pentafluoroselenium peroxygen compounds, fluorinated small ring heterocyclic compounds, and oxygen-fluorine compounds. Relevance - fluorides of certain nonmetals are very energetic, highly oxidizing, while those of others are highly stable. New examples and new methods to obtain new and familiar ones could have implications for oxidizer technology for rocket propulsion and for especially stable fluorinated materials.

The synthesis of pentafluoroselenium hydroperoxide will be attempted. The mechanism of perfluoroxazirine formation will be investigated and its chemistry exploited for the synthesis of other related compounds. New methods to prepare oxygen-fluorine compounds will be developed, and their use as fluorinating agents evaluated.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense, Army

3.0017, ELECTROPLASTIC EFFECT IN METALS
H. CONRAD, Univ. of Kentucky, School of Engineering, *Lexington, Kentucky* 40506 (DF047130; AF-AFOSR-3203-77)

AF function - Russian scientists have recently reported that plastic deformation of aerospace metals is strongly influenced by impressed electric fields and currents. This research offers a fundamental study of this phenomenological event so that aerospace vehicles, propulsion systems and structural materials might thereby be improved. Opportunity - a scientific explanation of the Russian breakthroughs in this area does not now exist. The opportunity and need for this research is critical for the national engineering community and results are urgently required. Objective - the objective of this work is to characterize the electroplastic effect in aerospace titanium and its alloys. The phenomena are to be interpreted in terms of micromechanics and extended to real systems involving metalworking problems of solid mechanics. How work contributes - part of the AFOSR mission is to provide a scientific understanding for complex engineering or technological problems. This research will serve the interests of the U.S. Air Force by giving solutions to foreign technology problems which are not yet understood.

Experimentally, this proposed research will evaluate the decrease in flow stress during uniaxial deformation at a constant strain rate and the attendant increase in creep rate which occurs upon the application of current pulses of short duration. The mechanical test variables which will be studied include temperature (78 to 1100K) and intermediate strain rates. The electrical variables will include voltage, current, wave form (including D.C. plus A.C. and frequency), number of carriers and pulse duration. Analytically, the program will attempt to interpret the behavior in terms of micromechanics and the interaction of electrons with dislocations. Generally, the data and results will be summarized as to their applicability for improved metalworking methods.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0018, MASS SPECTROMETRY AND ARTIFICIAL INTELLIGENCE
R.W. KISER, Univ. of Kentucky, Graduate School, *Lexington, Kentucky* 40506 (NCA 2-370701)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

3.0019, HIGH-TEMPERATURE GAS REACTIONS USING THE COMPLEMENTARY SHOCK TUBE TECHNIQUE
R.D. KERN, Louisiana State Univ. Systems, School of Science, *New Orleans, Louisiana* 70122 (CHE76-08529 A01)

The complementary shock tube technique continues to be a most powerful method to study the rates of reactions occurring exclusively in the gas phase at known temperatures, pressures, and densities. The strength of the method is the ability to record the dynamic behavior of reactants, products, and intermediates by utilizing two independent analytical techniques which when applied to the same reaction system provide a check on the sampling procedure and the validity of the experimental results.

The facility consists of two shock tubes. One tube is equipped to record simultaneously the infrared emission from two reacting species. The second tube is coupled to the ion source of a time-of-

flight mass spectrometer. By this technique, in addition to the internal check on the kinetic data, systems which achieve an observable equilibrium condition are subject to external check with the calculated thermodynamic equilibrium constant.

The self-exchange of nitrogen is being examined to complete the trilogy (H2 plus D2 and 13CO plus C18O) of fundamental exchange reactions. The exchange of 15N16O plus 12C18O is being examined to assess the effect of an unpaired electron upon the exchange process. Studies of other exchange processes are being undertaken. Considerable effort is being devoted to complex reaction systems such as CNCl plus H2 and to CNCl plus HCN. The pyrolysis of water as generated from the reaction of CO2 plus H2 at elevated temperatures is also being examined. This work is a continuation of that currently supported by Foundation grant, GP-33949X.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

3.0020, INVESTIGATION OF THE THERMOMECHANICAL BEHAVIOR OF POLYBENZIMIDAZOLE FILAMENT AND FABRIC

S. BACKER, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (NSG 2218)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

3.0021, STRUCTURE AND DYNAMICS OF ELECTRONICALLY EXCITED STATES OF DI- AND TRIATOMIC MOLECULES

R.W. FIELD, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (CHE75-05959 A01)

Dr. Field intends to carry out a program of research which employs tunable lasers for gas phase structural and energy transfer studies of small molecules. New techniques in tunable laser spectroscopy, including excitation spectroscopy, time resolved excitation spectroscopy, and optical-optical double resonance, will be utilized in order to observe and assign previously undetectable or unanalyzable molecular electronic transitions. Long lived electronically excited states, such as the lowest triplet state of alkaline earth oxides and sulfides (3 pi i or 3 sigma plus) and the lowest 2 delta state of alkaline earth halides, regardless of their frequent absence from compilations of spectroscopic data, are likely to be important energy reservoir states in exoergic reactions.

Characterization of long lived states, states with large internuclear distance and states near their dissociation limits will form major foci of the spectroscopic part of this research program. Two types of energy transfer experiments will be performed. Velocity changes which accompany collision induced rotational transitions will be observed by optical-optical double resonance. Collisional transfer between spin multiplets, lambda doublets, and levels of mutually perturbing electronic states will be studied with the goal of determining how isolated molecule structural information can be useful in understanding energy transfer processes more complex than those in unperturbed sigma 1 states.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

3.0022, GENERAL PURPOSE 2-D ELASTICITY COLLOCATION CODE

P.G. TRACY, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4810)

The objective of this project is to develop a general formulation and associated computer coding for the calculation of the stress intensity factors, stress concentration factors, displacements, and stress states which are needed to assess the operational life and reliability of Army material. The code will be written in a modular construction allowing rapid formulation and solution for such diverse problems as partially closed cracks in residual stress fields of pressurized tubes and cracks emanating from riveted aircraft structures.

The modified-mapping collocation method developed at AMMRC will provide the analytic approach to be used.

ADDENDA: Supporting agency address is: DARCOM Materials Mechanics Research CTR, Attn- DRXMR-X, Watertown, MA 02172

SUPPORTED BY U.S. Dept. of Defense, Army

3.0023, RESEARCH ON UNSTEADY COMBUSTION PROCESSES

M. SUMMERFIELD, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (DF045780; AF-AFOSR-3104-76)

AF function - most advanced Air Force strategic and tactical rocket weapons rely on solid propellants for propulsion. Deficiency - more energetic and reliable propellants are required for future weapons. Objective - this research is aimed at increasing the understanding of the unsteady combustion process which occurs in solid propellants, especially in the areas of velocity coupled instabilities and the burning of aluminum droplets. How work contributes - the understanding gained will permit the design of more reliable high-performance missiles.

This research is divided into two well-separated portions. The first is a combined analytical and experimental effort examining velocity coupling effects in realistic motor configurations. The throat area of laboratory sized, highly loaded motors is reliably oscillated to produce repeatable fluctuations in chamber pressure and velocity. The analysis utilizes experimental results to predict motor behavior where slow gas-phase reactions are important or where metal agglomerates are present. The second portion of the effort studies the behavior of metal agglomerates after they have the surface of a burning propellant with realistic cross flow velocities. High-speed photographic techniques are employed in the latter effort to provide insight into the burning metal behavior.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0024, ADSORPTION, SEGREGATION AND REACTIONS AT METAL SURFACES

J.M. BLAKELY, Cornell University, School of Engineering, *Ithaca, New York* 14850 (DMR76-23537)

Experimental research concerned with the structure and binding of adsorbed and segregated layers on solids, direct surface-vapor reactions, and surface catalyzed reactions previously supported by NSF grant DMR75-23647 will be continued. Specific projects to be carried out include: a study of the segregation and bonding of carbon atoms to transition metal surfaces and the effect of ordered adsorbed structures on surface reaction rates; a study of the mechanisms of adsorption and oxide formation on group II divalent metals (Be, Mg, Zn), and; a study of the interaction of halogens with silver single crystal surfaces with reference to surface catalyzed reactions and surface photographic processes.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0025, DEFECTS OF METAL CRYSTALS

D.N. SEIDMAN, Cornell University, School of Engineering, *Ithaca, New York* 14850 (EY-76-S-02-3158)

Properties of self-interstitial atoms, aggregates of self-interstitial atoms, the interaction of solute atoms (both interstitial and substitutional) with self-interstitial atoms, the non-equilibrium segregation of solute atoms to voids, the migration energy of interstitial helium in tungsten and the range of helium in tungsten, and the range of focusing collision sequences in pure metals and ordered alloys will be studied. Of interest are atomic configurations, migration energies, binding energies, electrical resistivities, energy losses per unit length of focused collision sequence track, concentration profiles around irradiation-induced voids and the point defect structure of depleted zones. Experimental techniques will include field-ion microscopy, atom-probe field-ion microscopy, low temperature electrical resistivity measurements, and a newly developed special technique for study focusing phenomena. (A) The Study of the Transmission Sputtering of Gold; (B) Atom-Probe Field-Ion Microscope Studies; (1) Spatial

distribution of atomic species in alloys; (2) The range and mobility of helium in tungsten; (3) Helium bubbles in molybdenum, (C) The Point-Defect Structure of Depleted Zones; (1) Depleted zones in a Pt-4.0 at.% Au alloy; (2) Results on tungsten irradiated with 30 keV Cr plus, Mo plus or W plus ions; (3) Influence of interstitial nitrogen on self-ion damage in tantalum; (4) Influence of interstitial gases on self-ion damage in tungsten; (5) Depleted zones in order-disorder alloy; (D) The range of a focused collision-replacement sequence in ordered alloys; and (E) The Fast Neutron-Irradiation of Wire Specimens in EBR-II.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

3.0026, HIGH-TEMPERATURE LOW-CYCLE FATIGUE AND CRACK PROPAGATION
S.D. ANTOLOVICH, Univ. of Cincinnati, School of Engineering, *Cincinnati, Ohio* 45221 (NSG 3147)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

3.0027, ROLLING, FORMING AND JOINING TITANIUM ALUMINIDE SHEETS
I. WRIGHT, Battelle Memorial Institute, *Columbus, Ohio* 43201 (DF680840; F33615-75-C-1168)

The objective of this program is to establish fabrication procedures and resulting properties for titanium aluminide base alloys rolled to sheet of varying thickness, formed into complex shapes, and joined together into scaled component assemblies typical of those used in aircraft turbine engines.

This program shall consist of three phases to be accomplished simultaneously. Phase A shall be a further investigation into sheet rolling techniques leading to thinner, wider sheet than is now available. Phase B will be an exploratory study of sheet forming by several methods. Phase C is an exploratory investigation of joining sheet materials by welding, and diffusion bonding.

ADDENDA: Supporting agency address is: AF Materials Laboratory LLM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0028, FUNDAMENTAL STUDIES OF METAL FLUORINATION REACTIONS
R.A. RAPP, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (EY-76-S-02-2671)

Solid calcium fluoride crystals are being used as electrolytes in galvanic cells for the determination of thermodynamic data and in kinetic investigations involving the solid-state coulometric titration of fluorine into solid nickel and copper. The A.C. electrical conductivities of beta-PbF2 and NiF2 crystals are being measured as a function of fluorine activity which is established via solid-state electrochemical cells. Hebb-Wagner D.C. conductivity measurements are made to determine the partial electrode conductivities in PbF2, NiF2 and CaF2. The use of CaF2 electrolytes in galvanic cells involving electrodes of fixed fluorine and oxygen activities is being studied to explain the defect chemistry and electrochemistry of oxygen dopant in CaF2.

RESULTS: Some unusual, significant results have already been achieved. Electrochemical measurements have provided good data for the solubility and diffusivity of fluorine in copper; the values are similar to those for oxygen in copper. Surprisingly, nickel fluoride has been found to exhibit a significant ionic transference number. The partial p-type electronic conductivities of CaF2 and beta-PbF2 at relatively high PF2 are significant. The doping of CaF2 by oxygen results in its functioning as an oxygen electrolyte.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

3.0029, 450 F ADHESIVE FOR BONDED HONEYCOMB AND LAMINATES
J. FASOLD, Rockwell International Corp., *Columbus, Ohio* 43216 (DN681295; N62269-75-C-0400)

To develop adhesives for bonded honeycomb and laminates capable of withstanding the thermal cycles which would be experienced in-service on an advanced VTOL aircraft.

Characterization studies will be made on several candidate systems. Bonding studies will include metal surface treatments for titanium, stability of cured adhesive systems at high temperatures in presence of moisture, degradation under static and dynamic loading and optimum cure procedures.

ADDENDA: Supporting agency address is: Naval Air Development Center, Air Vehicle Technology Dept., Warminster, PA

SUPPORTED BY U.S. Dept. of Defense, Navy

3.0030, TURBINE ENGINE LUBRICANT DEVELOPMENT
G.A. BEANE, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF451060)

Develop new lubricants and define requirements for current and proposed turbine engine and power generation systems.

Interpret existing and advanced engine lubrication requirements to the petroleum and chemical manufacturing industry in terms of lubricant physical property and performance criteria requirements. Provide guidance to internal and contractual research programs to assure the timely development of evaluation techniques capable of defining pertinent lubricant performance characteristics.

ADDENDA: Supporting agency address is: AF Aero-Propulsion Laboratory SFL, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0031, SURFACE AND MECHANICAL PROPERTIES OF SILICON NITRIDE BEARING ELEMENTS
H. DALAL, S K F Industries Incorporated, *Norristown, Pennsylvania* 19406 (DN490017; N00019-76-C-0147)

To determine parameters such as surface distress, lubrication requirements, friction and wear behavior, etc., needed for the design of silicon nitride elements as future aircraft turbine engine bearings.

Silicon nitride ball bearings will be endurance tested for wear comparison with conventional steel bearings. Friction and wear characteristics of silicon nitride will be evaluated as a function of surface finish. Spall morphology and surface distress will be examined by optical and scanning electron microscopy.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20360

SUPPORTED BY U.S. Dept. of Defense, Navy

3.0032, LOW-TEMPERATURE FLUORINE CHEMISTRY OF ELECTRONEGATIVE ELEMENTS
G. MAMANTOV, Univ. of Tennessee, School of Liberal Arts, *Knoxville, Tennessee* 37916 (DF046520; AF-AFOSR-3165-77)

AF function - future Air Force space explorations require improved propulsion and power systems. Deficiency - new synthesis techniques for preparing more energetic materials are needed. Objective - the research involves cryogenic synthesis of strongly oxidizing species of fluorine and other electronegative elements. How work contributes - the research will provide new approaches to the synthesis of high-energy materials.

The use of infrared lasers for excitation of low temperature reactions involving compounds with N-F and O-F bonds as well as fluorine will be investigated. This approach will be used to explore synthetic routes to tetrafluoroammonium salts. Other areas studied include reactions of fluorine atoms with compounds of electronegative elements in inert matrices, the use of UV photolysis and gamma-radiolysis for the production of new radicals, and radical-radical reactions in matrices.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0033, SIZE EFFECT STUDIES OF THIN METAL FILMS
S.J. BRIENT, Univ. of Texas, School of Science, *El Paso, Texas* 79902 (NSG 3146)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, VARIABLE GEOMETRY TORQUE CONVERTER
KOEPSEL, Signal Companies Incorporated, *Phoenix, Arizona* 85034 (DF455640; F33615-76-C-2013)

To design and evaluate a variable reactor system for the B-1 torque converter. Provides a means of varying the HP absorbed by the torque converter so that it can utilize all available APU output power under any conditions.

A mechanically variable stator (breadboard) shall be designed, fabricated and demonstrated in the existing B-1 developmental torque converter.

ADDENDA: Supporting agency address is: AF Aero-Propulsion Laboratory POP, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0002, TRAJECTORY ANALYSIS OF SALTATING PARTICLES
B.R. WHITE, Univ. of California, Graduate School, *Davis, California* 95616 (NCA 2-180704)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

4.0003, CRITICAL FAULT PATTERN DETERMINATION IN FAULT TOLERANT COMPUTER SYSTEMS
E.J. MCCLUSKEY, Stanford University, School of Engineering, *Palo Alto, California* 94305 (NSG 1410)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

4.0004, GUIDED WAVE OPTICS
A. YARIV, Calif. Inst. of Technology, School of Engineering, *Pasadena, California* 91109 (ENG76-04927 A01)

Research in the general area of semiconductor optoelectronic devices leading to integrated optical circuits will be undertaken. Emphasis will be placed on investigations relating to the injection laser and its coupling to other thin film devices. This work will include examination of the embedded heterostructure laser with external Bragg reflector, the growth of new compounds such as indium gallium arsenide for integrated optics, tapered couplers, and bi-composition waveguides.

This project is a continuation of research previously supported under NSF Grant ENG71-02374.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0005, ANALYTICAL/EXPERIMENTAL STUDY OF PASSIVE FIRE PROTECTION SYSTEMS
F. HOLMSTROM, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NSG 2224)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

4.0006, TRANSONIC 3-D FLOW ANALYSIS
P.R. DODGE, Canadian Commercial Corp., *Ottawa, Ontario, Canada* (DF460080; F33615-76-C-2071)

The objectives of this program are: (1) to develop a three-dimensional, transonic, viscous computer code capable of calculating flow through a turbomachine blade row with reasonable rapidity on a CDC 6600 class computer, and (2) to develop criteria for optimization of the design of splitter vanes when used in axial compressor blade rows. The application of the results is in improved accuracy of compressor blade-row designs resulting in higher efficiency and reduced development costs for aircraft turbine engines.

This contractor has adopted a relaxation technique for his numerical analysis which has the potential of solving three-dimensional, transonic, viscous flow problems on smaller computers and using less time than the currently operational time-dependent methods. The latter methods currently require several hours on a CDC 7600 class computer to solve the type of problem envisioned. The contractor will test his analysis against extensive experimental data which the Air Force has for a specific cascade configuration containing splitter vanes and will also be able to compare it with the results of contract F33615-76-C-2011 in which another contractor is analyzing the same configuration using a three-dimensional time-dependent code. Assuming that results of adequate engineering accuracy are obtained, the new 3-D code will be used to develop optimization criteria for the design of splitter vanes.

ADDENDA: Supporting agency address is: AF Aero-Propulsion Laboratory TBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0007, ELEVATED TEMPERATURE BOLTED JOINT TEST TECHNOLOGY IN COMPOSITE MATERIALS
R.B. PIPES, Univ. of Delaware, School of Engineering, *Newark, Delaware* 19711 (NSG 1409)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

4.0008, LOW-LOSS SELF FOCUSSING FIBER OPTIC WAVEGUIDES
P.B. MACEDO, Catholic University of America, School of Engin. & Arch., *Washington, District of Columbia* 20017 (DN590078; N00019-76-C-0083)

A research study directed toward the development of a new process for fabricating low-loss, inexpensive, wide acceptance angle optical fiber waveguides. The motivation for this work is the need for a suitable transmission path to a sonobuoy receiver from a sonar sensor in deep ocean locations.

The key part of this work is known as 'molecular stuffing.' the molecular stuffing method relies upon utilizing an initial glass melt composition in which phase separation can be induced with the impurities redistributing preferentially into one phase. This phase is then leached out with acid. The porous glass structure that remains in washed and suitable dopants are added--the molecular stuffing step--to produce a self-focusing refractive index profile. This is subsequently collapsed and drawn into an optical fiber.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0009, THE DYNAMICS AND CONTROL OF LARGE FLEXIBLE SPACE STRUCTURES
P.M. BAINUM, Howard University, School of Engineering, *Washington, District of Columbia* 20001 (NSG 1414)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

4.0010, IMPROVED CIG EDGE UTILIZATION STUDY
M. BUNKER, General Electric Company, *Daytona Beach, Florida* 32015 (DF228120; F33615-77-C-0033)

To develop new algorithms which will improve edge utilization in wide field-of-view (FOV) CIG visual simulation systems. In current wide FOV CIG systems, the edges are distributed over a large viewing angle, resulting in poor image detail. The poor

image detail, in turn, reduces the training effectiveness of the system. This study will develop algorithms which will concentrate the CIG edges into the primary pilot viewing areas. The pilot will be provided more and better visual cues without additional edges being processed by the CIG system. This improved utilization of edges will increase the training cost effectiveness of future CIG systems.

To analyze and develop two algorithms which will improve edge utilization of future CIG systems. These algorithms are for (1) new level-of-detail (LOD) change criteria and (2) a real-time, dynamic area-of-interest (AOI) image over a background scene. In current systems, the LOD change criteria is based upon nadir range. However, altitude, attitude and slant range are additional parameters which could be used to improve and increase the utility of the LOD algorithm. In the LOD algorithm to be developed, the above examples and other parameters are to be analyzed for use as new LOD change criteria. With this new LOD algorithm, the edges will be concentrated in the pilot's primary viewing area. In large FOV visual simulation systems, the pilot uses only a small, highly detailed FOV, termed AOI, at one time. If this AOI is constantly slewed to the pilot's look angle, the pilot will always view a highly detailed aoi image with a low detailed peripheral image. An algorithm will be developed which provides this dynamic detailed AOI without additional edges being processed by the CIG system. The algorithm will be used for generating the AOI but does not include methods of directing the AOI. Methods of detecting helmet position are being developed by AMRL and other organizations. This work will be drawn upon for determining the position of the pilot's eyes for directing the location of the AOI.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory ASM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0011, LASER AIR-TO-GROUND WEAPON DELIVERY
A.H. MARSHALL, U.S. Navy, Physical Sciences Laboratory, *Orlando, Florida* 32813 (DN694002)

Develop a method of training pilots in air-to-ground gunnery. The device will utilize an eye-safe laser and will reduce the costs of ammunition, eliminate hazards to personnel, require less support personnel, i.e., aviation ordnance men and supply personnel, and allow simulation of moving ground targets.

Evaluate the equipment and methods developed for air-to-air weapon fire simulation for application to air-to-ground weapon fire simulation. Develop necessary modifications and develop new target configurations.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Instrument and Flight Controls, Washington, D. C. 20360

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0012, NAVY ISD PROGRAM SUPPORT
W.W. PROPHET, Human Resources Research Org., *Pensacola, Florida* 32505 (DN794003; N61339-77-C-0009)

This project is related to a current NavTraEquipCen 6.2 ISD program to establish the management and technical procedures for implementation of ISD in aviation training programs. This particular effort will provide a comparative analysis of the ongoing NTEC ISD program involving simultaneous application of ISD methodology to four different aircraft systems.

The procurement documents, procedures, and products of the ongoing ISD program will be examined to determine the extent to which these materials and techniques are sufficient for implementation. This comparative analysis will yield recommendations concerning synthesizing and standardizing ISD requirements, formats, specifications, and DID's.

ADDENDA: Supporting agency address is: Naval Training Equipment Center, Human Factors Lab, Orlando, FL 32813

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0013, RESEARCH INITIATION - OPTIMUM ENCODING OF HOLOGRAPHIC INFORMATION IN DIGITAL FORM WITH APPLICATIONS TO LASER MACHINING
N.C. GALLAGHER, Purdue University, Graduate School, *Lafayette, Indiana* 47907 (ENG76-82426)

The purpose of this research is two-fold: 1) to determine the optimum coding of information in digital holograms and 2) to investigate the application of digital holography to laser machining. Attempts will be made to use an entirely new type of binary-phase digital reflection hologram in order to project an image pattern on a work piece. By using very intense infrared laser radiation, material will be burned from the work piece according to the image pattern. The hologram itself will not be destroyed by the intense radiation because it is nearly 100% reflective. This novel application of digital holography raises a number of questions that will be investigated concerning the best method for coding information in a digital hologram. Should the complex-valued holographic samples be stored in polar form or rectangular form? How do defects in our reflection holograms degrade the image? What is acceptable image quality for laser machining?

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0014, EVALUATION OF THE RADIATION TOLERANCE OF INTEGRATED INJECTION LOGIC
W.M. SHEDD, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF901220)

AF function - weapons delivery, communications of Air Force space and missile systems. Deficiency or opportunity - current Air Force radiation hardness requirements are not being met. Objective - to evaluate the radiation tolerance of integrated injection logic in the various radiation environments required by Air Force systems. How research contributes - the significant electrical performance advantages of integrated injection logic, including increased speed, reduced power and increased packing density, cannot be made available to Air Force systems until the radiation tolerance of this technology is established and, if necessary, improved.

Samples of integrated injection logic integrated circuits will be obtained from various manufacturers along with the pertinent device geometries and fabrication procedures used in the manufacture. Complete electrical evaluation of these units will be made before radiation exposure to establish their performance and to serve as a base line for the changes in electrical performance resulting from subsequent radiation exposure. The devices will be exposed to the various radiation environments required by current Air Force systems specifications. These exposures will be made as a function of radiation dose and dose rate in order to determine the sensitivity of device degradation to each nuclear radiation environment (neutron, total gamma dose, and dose rate). The electrical performance of the devices will be evaluated after exposure at each radiation dose level and the changes in device performance will be correlated to the device geometries and material properties to obtain an understanding of the degradation mechanisms. As a result of these experiments the tolerance of the devices to radiation will be determined and possible methods for improving this tolerance will be recommended. In particular, recommendations on the applicability of these devices for use in Air Force systems with different radiation requirements will be made.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0015, IMAGING ALL-SKY PHOTOMETER
R.H. EATHER, Keo Consultants, *Newton, Massachusetts* (DF901150; F19628-76-C-0168)

AF function - communications and detection. Deficiency - understanding effects both of precipitating particle and non-particle produced ionospheric disturbances which degrade communications at high and equatorial magnetic latitudes. Objective - investigate ionospheric disturbance phenomena by means of auroral spectral emission features measured with a sensitive T.V. system. How research contributes -provides a new and powerful technique for large-scale and high time resolution auroral measurements. Coordination with other simultaneous measurements from the AFCRL Airborne Ionospheric Observatory, NKC-135 aircraft, number 53131, will allow comprehensive measurements of ionospheric response to substorms over subauroral, auroral and polar cap domains.

Design, develop and construct an ultra high-sensitivity, low-light-level T.V. system capable of wavelength discrimination, all-sky viewing and signal processing to accurately measure auroral emissions in the visible region of the spectrum.

ADDENDA: Supporting agency address is: Rome Air Development Center ETE, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0016, FUNDAMENTAL ASPECTS OF GAS TURBINE COMBUSTION

J.A. NICHOLLS, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (NSG 3148)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

4.0017, MAGNETIC TAPE RECORDING SYSTEMS (THREE)

J. BRADLEY, Scientific Recording Syst. Inc, *Albuquerque, New Mexico* (DN681278; N62269-75-F-6434)

Fabricate three (3) Mark IIB data acquisition systems. The magnetic tape recording system, Model 2311S, is used in the system to record flight loads information. These data are used to update aircraft design criteria. This contract supports work unit ZA101, Agency Accession No. DN681080.

These recording units are production models and have been flight-tested by NADC. The tape outputs are computer compatible. Each unit can record up to 40 channels of data.

ADDENDA: Supporting agency address is: Naval Air Development Center, Air Vehicle Technology Dept., Warminster PA

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0018, DEVELOPMENT OF A DESIGN FOR A LOW-BACKGROUND FOCAL PLANE TESTER

J.R. HOUCK, Cornell University, School of Arts & Sciences, *Ithaca, New York* 14853 (NCA 2-175703)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

4.0019, AXIALLY GROOVED HEAT PIPE STUDY

Y. KAMOTANI, Case Western Reserve Univ., Graduate School, *Cleveland, Ohio* 44106 (NAS 5-24144)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

4.0020, COMPUTATION OF UNSTEADY STABILITY DERIVATIVES FROM A SIMPLIFIED AERODYNAMIC FORCE MODEL

W.R. WELLS, Wright State University, Graduate School, *Dayton, Ohio* 45431 (NSG 1417)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

4.0021, VERY HIGH-GAIN OPTICAL PARAMETRIC INTERACTIONS

G.A. MASSEY, Oregon Grad. Ctr. Stu. & Res., *Beaverton, Oregon* 97005 (ENG73-03795 A01)

The purpose of this work is to study coherent optical sources with wavelength tunability and controlled bandwidth and frequency stability by means of high-gain parametric amplification in crystals. Intense pulses of nanosecond to picosecond duration have already been demonstrated. The current research is directed toward controlling and compensating for the large intensity fluctuations observed on the output pulses from these devices. A saturable absorber in a negative feedback configuration will be investigated to stabilize the intensity and tunable compound amplifiers consisting of a parametric crystal input stage and a dye laser output stage will be examined to produce larger output energies. The limitations of these devices in the production of ultrashort pulses less than 10 picoseconds in duration will be explored. This light source is useful as a probe in various chemical and physical experiments, in remote sensing of the atmosphere and in evaluating dispersion and scattering in optical communication channels.

This action renews the research currently supported under NSF Grant ENG73-03795.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0022, PROCESSING OF ADVANCED ELECTROMAGNETIC WINDOWS - CHEMICALLY VAPOR DEPOSITED SILICON NITRIDE

R.A. TANZILLI, General Electric Company, *Philadelphia, Pennsylvania* 19101 (DN675314; N00014-76-C-0547)

Future naval tactical missiles will need IR domes, radomes, and perhaps even dual-mode capabilities in the same electromagnetic transparency. Presently used materials are not suited for use in such systems because the operating environment will impose severe conditions such as mechanical and thermal loading, impact-caused erosion, and optical or electrical property changes beyond the useful capabilities they possess. In addition, the possibility of dual mode operation emphasizes the need for greatly improved or novel materials. In addition to possessing useful mechanical, thermal, optical, electrical and chemical properties, such materials must have the potential for fabricability demonstrated. Chemically vapor deposited (CVD) silicon nitride appears to satisfy these requirements. This research task will investigate areas of processing research, materials characterization and property determinations which will establish the suitability of CVD-Si3N4 as a potential multi-mode electromagnetic window material for use on future naval missile systems.

During the first year, preliminary processing parameters for preparing visible, infrared and radar transparent CVD-Si3N4 in polished 2 mm thicknesses will be selected. This includes effects of temperature, pressure, residence time, reactant nature and ratio, substrate character on stoichiometery, microstructure and deposition rate. Also, preliminary microstructural correlation with critical optical (transmittance, reflectance), electrical (resistivity, dielectric constant, loss tangent) and mechanical strength hardness) will be established.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0023, ADVANCED TECHNOLOGY AIRSHIPS CENTER OF EXCELLENCE TEAM

H.V. BORST, Henry V. Borst & Associates, *Wayne, Pennsylvania* 19087 (DN681078; N62269-76-M-6014)

To provide experienced technical support to the center of excellence for lighter-than-air in the areas of aerodynamics, propulsion, dynamics, control and mission analysis. This contract is in support of DH805, DN581059.

Review the available literature being generated on LTA. Attend and participate in general meetings of LTA and visit, where necessary, those engaged in work on the subject. Report and summarize important work and recommendations on LTA. Provide technical support on those projects that appear to need assistance in the fields of our expertise and recommend research programs to correct any deficiencies. Review new concepts and make necessary recommendations. Conduct special studies as assigned.

ADDENDA: Supporting agency address is: Naval Air Development Center, Air Vehicle Technology Dept., Warminster PA

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0024, FLOW FIELD STRUCTURE

L. SIROVICH, Brown University, Graduate School, *Providence, Rhode Island* 02912 (DN623024; N00014-75-C-0288)

The determination of theoretical methods for the accurate prediction of the flows about high speed bodies at all altitudes is essential for the design of missiles and aircraft. This research is directed to the development of a very fundamental understanding of special problems in fluid dynamics, with particular emphasis on far-field solutions of the Navier-Stokes equations.

A continuing effort is being directed to the study of high-speed flows. Particular emphasis has been, and will continue to be, devoted to the study of far-field solutions of the Navier-Stokes equations and the structure of the flow fields. In these studies, the far field can be described in terms of integral properties of the body (lift, drag, etc.). Such descriptions of the flow, extremely important in their own right, may, in addition, prove valuable in the description of the complete fluid domain when used in combination with detailed numerical calculations of the near field.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0025, COMMUNICATIONS - DIGITAL FILTERS IN COMMUNICATIONS AND CONTROL

D.W. TUFTS, Univ. of Rhode Island, School of Engineering, *Wakefield, Rhode Island* 02881 (DN223029; N00014-68-A-0215-0006)

Navy satellite, ship-to-ship and ship-to-shore communications systems, as well as guidance and fire-control loops use digital modulation and control signalling. These signals must be discernible in the presence of channel, atmospheric, 'back-lash' and other types of noise. Digital filters are essential elements in the reduction of absolute noise, and in the improvement of signal-to-noise ratios in these systems.

The abdominal ganglion from Aplysia californica is dissected out and mounted in sea water in a pressure vessel. Two microelectrodes are placed inside neuron r15: one for recording and the other for passing current. A third electrode is placed extra-cellularly for stimulation of synaptic input. The amplitude and time course of the excitatory post synaptic potentials (EPSP) are monitored with an oscilloscope and computer which analyzes the amount of facilitation throughout the train at sea level and at 10 ATA.

ADDENDA: Supporting agency address is: Office of Naval Research 427, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0026, OPTIMIZATION OF FIBER REINFORCED STRUCTURES TO SATISFY AEROELASTIC REQUIREMENTS

C.S. RUDISILL, Clemson University, School of Engineering, *Clemson, South Carolina* 29631 (NSG 1411)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

4.0027, APPLICABILITY OF RELIABILITY & SURVIVABILITY PROGRAM-VERSION I TO MODEL RELIABILITY & SURVIVABILITY CHARACTERISTICS OF AIRCRAFT WEAPON SYSTEMS

J.W. FOSTER, Texas A & M University System, School of Engineering, *College Station, Texas* 77843 (NSG 2226)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

4.0028, PHOTOREFRACTIVE PROCESSES FOR OPTICAL STORAGE AND DISPLAY

C.M. KIM, Rice University, School of Engineering, *Houston, Texas* 77001 (ENG76-15006)

This program will examine holographic data storage and display in photorefractive materials. The thrust will be twofold: (1) theoretical and experimental investigation of the physical processes and relevant crystal properties responsible for the photorefractive effect and the limitations imposed by them on desired device parameters, and (2) preparation of crystals with optimal properties and investigation of convenient techniques for the development of optical memory devices with predictable and desired characteristics. The crystals to be investigated include several transition metal doped ferroelectrics. Characteristics of drift and photogenerated space charge fields in the crystals will be examined using holographic, photoelectronic, and chemical measurement techniques.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0029, INVESTIGATION OF THE FEASIBILITY OF THE ELECTRON BEAM-EXCITED HIGH-PRESSURE CHARGE TRANSFER LASER

C.B. COLLINS, Univ. of Texas, Graduate School, *Richardson, Texas* 75080 (ENG74-06262 A01)

The objective of this research is the continuation of studies to verify the feasibility of developing an electron beam excited helium plasma into a collisionally pumped laser emitting in the visible or near-UV with 5-29% efficiency. The developing kinetic model has reached a level of sophistication sufficient to predict thermal scaling, recently observed in this work. Continuation of the two ongoing lines of research currently pursued involves measurements of the rate coefficients of the elementary reactions of importance to potential laser pumping sequences, and the demonstration that useful laser outputs can be pumped. This is a continuation of research previously supported under NSF grant ENG-7406262.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0030, AIR TRANSPORTATION SYSTEMS RESEARCH

A.R. KUHLTHAU, Univ. of Virginia, School of Engin. & Appl. Sci., *Charlottesville, Virginia* 22903 (NAS 1-14908)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

4.0031, PRIMARILY ADHESIVELY BONDED STRUCTURE REPAIR

R. HORTON, Boeing Company, *Seattle, Washington* 98108 (DF138370; F33615-76-C-3137)

New and innovative type structures will be developed under the primary adhesively bonded structure (PABST) advanced development program. When incorporated in aircraft systems, economical means of maintenance and repair must be available. This effort will develop needed criteria and techniques to perform cost effective repair for the new structural concepts.

Cost effective repair criteria and techniques applicable to adhesively bonded structure on military aircraft will be developed. consideration will be given to the capabilities of AFLC depots as required to implement the results of this effort. A number of specific repairs will be made on which structural tests will be conducted.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBSA, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0032, GENERALIZATION OF ANALYTICAL TOOLS FOR HELICOPTER ROTOR AIRFOILS

E.H. GIBBS, West Va. University, Graduate School, *Morgantown, West Virginia* 26506 (NSG 1412)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, DOPPLER SPREAD IMAGING
J.S. BENNETT, U.S. Army, Missile Res. Dev. & Eng. Lab., *Huntsville, Alabama* 35809 (DA0F1012)

The objective is to investigate and apply optical Doppler spread imaging techniques to take advantage of the very large number of data processing channels allowed by these techniques exploits the Doppler frequency shift due to relative motion between a target and a transceiver to detect spatial information about the target. Potential applications include laser radar signal processing, air defense target discrimination, airborne terrain mapping, and photo reconnaissance.

Techniques utilizing the temporal filtering property of holograms to perform the frequency analysis of the Doppler spectrum on the laser light reflected from the target will be investigated. Methods for extending the technique to two dimensions will be pursued. Electrooptic techniques will be investigated as a means to up-grade the information processing to a real-time capability.

ADDENDA: Supporting agency address is: MICOM Physical Sciences Directorate, Army Msl RD E Lab, Redstone Ar., AL 35809

SUPPORTED BY U.S. Dept. of Defense, Army

5.0002, OPERATION OF A PAIR OF IONOSONDES NEAR MAGNETIC LATITUDE 76 DEGREES FOR STUDIES OF THE MAGNETOSPHERIC CLEFT
H.C. STENBAEKNIELSEN, Univ. of Alaska, Geophysical Institute, *Fairbanks, Alaska* 99701 (ATM76-23451)

This grant will continue the operation of the C-3 ionosondes at Sachs Harbor and Cape Parry as an International Magnetospheric Study (IMS) activity. The sounders have proven successful in determining the location of the dayside magnetospheric cleft (or cusp), and this ability has been utilized in a number of rocket, satellite and radar experiments. With the Alaskan magnetic meridional chain of magnetometer stations going into full operation in 1977, the value of the sounder data will increase. The sounders will operate approximately 4 weeks every 4 months and the data will be analyzed for the daytime location of the cleft, and its relation to other geophysical parameters. Joint experiments with other groups and the operational schedule will be kept flexible to accommodate as many experiments and special IMS periods as possible. Joint projects currently planned include a rocket launch by the National Research Council of Canada to investigate the noon-sector of the auroral oval and simultaneous cusp studies using the sounders and a new digital ionosonde being developed at NOAA, Boulder.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0003, INFRARED STUDIES OF VARIOUS ICES
U. FINK, Univ. of Arizona, Lunar & Planetary Laboratory, *Tucson, Arizona* 85721 (NCA 5-75)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0004, CHARACTERIZATION AND AMELIORATION OF PROBLEM SOILS
H.M. REISENAUER, Univ. of California, Agric. Experiment Station, *Davis, California* 95616 (0066508; CA-D0-SPN-3201-H)

OBJECTIVE: Characterize soils with natural and/or management-induced profile features inhibitory to plant growth; gain a better understanding of chemical and physical mechanisms contributing to such problems; and seek and evaluate remedial measures.

APPROACH: Soils with horizon problems will be trenched or backhoed with appropriate amendments, planted to orchard trees, and growth rates evaluated. The mineralogy and physical features of slowly permeable, coarse-textured soils will be evaluated to determine the distinctive features and the cause of slow water movement. Soils at different stages of acidification will be collected and characterized chemically, mineralogically and as crop growth media.

PROGRESS: Samples of naturally occurring and agriculturally acidified soils were collected, characterized chemically, and their lime needs evaluated in the greenhouse. Lime additions either increased, depressed, or had no effect on yields. Yield increases were attributed to reduced toxicities of Mn and Al and increased Mo availability. Yield depressions resulted from decreased availability with liming of B, Mn and Zn. Response to lime occurred on soils with at least 0.2 meq Al/100g, were maximum at soil pH near 6.0, and were not predicted by soil pH or exchange acidity. Soil and cropping characteristics required for lime need assessment are being defined. Aerial photographs, using several combinations of film, emulsions and filters, were taken of an area, cropped for the first time to cotton, which had been the site of salinity-boron reclamation experiment in 1969-70. The manure (200 T/A) treatment showed the greatest response. Fourteen of the 16 manure-treated plots were visually identifiable on color infrared prints. Other amendment and tillage treatments could not be differentiated but the plot size was visible--the effects of 20 feet of water used in the experiment.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, California

5.0005, TETHERED SUB-SATELLITE STUDY
P.J. COLEMAN, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (NAS 8-32571)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0006, METHANE AND STRATOSPHERIC WATER
Y.L. YUNG, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (NSG 2229)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0007, ANALYSIS OF INTERACTION BETWEEN SPACECRAFT AND ARTIFICIALLY INJECTED PARTICLES
E.C. WHIPPLE, Univ. of California, Graduate School, *San Diego, California* 92037 (NSG 3150)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0008, EFFECT OF LAYERING ON VISCOUS FLOW OF LUNAR CRATERS
H.R. AGGARWAL, Univ. of Santa Clara, Graduate School, *Santa Clara, California* 95053 (NSG 7330)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0009, ASSESSMENT AND ANALYSIS OF IMAGE DATA ANALYSIS SYSTEMS FOR OPERATIONAL NEEDS FOR THE STATES OF THE PACIFIC NORTHWEST
R.L. DANIELSON, Univ. of Santa Clara, Graduate School, *Santa Clara, California* 95053 (NCA 2-685710)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0010, AN EVALUATION OF THE EFFECTIVENESS OF COMMUNICATION SATELLITES FOR THE PACIFIC NORTHWEST LAND RESOURCES INVENTORY PROJECT
T.J. HEALY, Univ. of Santa Clara, School of Engineering, *Santa Clara, California* 95053 (NCA 2-685711)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0011, PRECIPITATION EFFECTS ON LASER BEAMS
W.K. KLEMPERER, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8AA7 03 12)

PROJECT OBJECTIVE: Experimental studies of the use of laser beams for remotely measuring atmospheric precipitation.

CURRENT YEAR PLAN: The laser beam fluctuations produced by precipitation will be observed and analysed with respect to variance, co-variance, and frequency spectrum to assess the feasibility of measuring precipitation on line-of-sight paths.

PROGRESS REPORT: Preliminary covariance measurements, made in the laboratory and through actual rain outdoors, demonstrate that it will be possible to measure rainfall quantitatively. An outdoor test range has been constructed to help us test the maximum path-length capability of optical rain sensing.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0012, STORM ELECTRICITY
E.T. PIERCE, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8C370409)

PROJECT OBJECTIVE: The project has two main objectives, namely: (1) To obtain information on the electrical characteristics of local storms and lightning; (2) To associate the electrical properties with radar information on storm reflectivities and wind fields.

CURRENT YEAR PLAN: This falls into two divisions, namely: (1) To colocate a lightning mapping system with the Norman Doppler radar and to compare the radar and lightning results; (2) To install and operate electrical equipment for investigating storm and lightning properties. The equipment will include a field-mill and a special antenna.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0013, AIRCRAFT OPERATIONS
R.A. MILLS, U.S. Dept. of the Interior, Geological Survey, *Denver, Colorado* 80225 (9790-00917)

The Branch of Petrophysics and Remote Sensing has recently acquired a new turbo-powered S.T.O.L. (short takeoff and landing) research airplane, a Fairchild Industries Heli-Porter Model PC-6. The plane is well adapted to handle the variety of speed, altitude and terrain constraints needed to support geophysical airborne studies. It can be used as a low-altitude low-speed platform for long integration time observations such as the VLF, gamma-ray spectrometry, and active and passive microwave studies. Sensors will also be mounted on a wingtip for surveys with a proton magnetometer. The aircraft also is well suited for remote-sensing geophysical surveys with the Branch multispectral scanner. As a result of a recent modification the scanner can now collect 9 channels of information (including the four LANDSAT-MSS bands and the 10 microns thermal window).

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0014, ATOM-MOLECULE REACTIONS OF CHEMICAL IMPORTANCE IN THE STRATOSPHERE
J.B. HUNT, Catholic University of America, School of Arts & Sciences, *Washington, District of Columbia* 20017 (NSG 5173)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0015, ANALYSIS OF REMOTELY SENSED SIGNATURES (SURVEILLANCE)
I. JURKEVICH, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680432)

To develop mathematical techniques for extraction of naval surveillance information from medium resolution space acquired imagery, to implement such techniques in an interactive man-machine instrument complex, and to permit fast, nearly optimum interpretation of image material.

Methods of image coding, point to point transform-ations, pattern analysis, spatial domain analysis for variant point spread functions, etc., in their digital formulation will be applied to typical imagery to test their applicability to naval surveillance of both the environmental and 'target' type. Certain aspects of image processing lead to non-linear mathematical formulations which remain unexplored. Practical implementation of even the simpler linear problems has been sketchy and the limits to which they can be extended is unknown.

ADDENDA: Supporting agency address is: Naval Research Laboratory (7000), Washington, D.C. 20375

SUPPORTED BY U.S. Dept. of Defense, Navy

5.0016, NUMERICAL AND THEORETICAL RESEARCH ON THE SOMALI CURRENT
S.A. PIACSEK, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680113)

To model and understand the dynamics of consistently observed features of the Somali Current. This study will form an important part of the more general numerical studies of mesoscale, one-basin and global ocean circulations. These models will be used to forecast upper ocean layer environment from observational data, including satellites.

The general approach will be to solve numerically the equations of hydrodynamics and thermodynamics relevant to the Indian Ocean on large digital computers. The techniques employed (e.g., finite differences, stretched grids, etc.) will be specifically tailored to the Somali Current region and the monsoon time scale. The model will use a semi-implicit two-layer hydrodynamical-thermodynamical model with variable coastline, bottom topography, stretched grids, vertical mixing, and solar insolation. Special attention will be paid to the role of upwelling and meridional heat transport.

ADDENDA: Supporting agency address is: Office of Naval Research (481), Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

5.0017, SATELLITE FREEZE FORECAST SYSTEM
J.F. BARTHOLIC, State University of Fla. Sys., School of Agriculture, *Gainesville, Florida* 32601 (NAS10-9168)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0018, THUNDERSTORM RESEARCH INTERNATIONAL PROJECT - 1977
C.S. WILSON, Georgia Inst. of Technology, Graduate School, *Atlanta, Georgia* 30332 (NAS 5-24148)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0019, REMOTE COMPOSITIONAL MAPPING OF THE LUNAR SURFACE
T.B. MCCORD, Univ. of Hawaii, Graduate School, *Honolulu, Hawaii* 96822 (NSG 7312)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0020, APPLICATION OF REMOTE SENSING TO VEGETATION AND SOILS IN SOUTHERN IDAHO
E.W. TISDALE, Univ. of Idaho, Agric. Experiment Station, *Moscow, Idaho* 83843 (0069406; IDA-ES-0073)

OBJECTIVE: Determine and map the major vegetation types of the study area and identify the soils associated with this vegetation.

APPROACH: Multispectral ERTS imagery (70 mm) will be viewed singly and in color-enhanced combination with a Spectral Data Viewer/Projector. At a scale of 1:250,000 all observable images will be delineated. Ground-truth inspections, particularly of image sites of unknown or questionable interpretation, will be made. At each inspection site the vegetation and soils will be characterized and classified by a scheme developed by Poulton of Oregon State University. Delineated images of like classification will be coalesced into simple images to produce a second-generation vegetation map from ERTS imagery. A soil association map will be produced independently of the vegetation map. Soil bodies will be delineated on the basis of land form geologic parent material, gross vegetational features, and image color and density.

SUPPORTED BY Idaho State Government

5.0021, WATER VAPOR LINE STRENGTHS AND PRESSURE BROADENING BELOW 1 MICRON WAVELENGTH
T.D. WILKERSON, Univ. of Maryland, Inst. for Fluid Dyn. & Math., *College Park, Maryland* 20742 (NSG 2216)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0022, TERMINAL WEATHER PREDICTION - MEDIUM-RANGE AVIATION FORECASTING
R.L. CRISCI, U.S. Dept. of Commerce, Techniques Development Lab., *Suitland, Maryland* 20233 (8D5905)

TECHNICAL OBJECTIVE: To develop and implement new and improved automated techniques for the prediction of aviation weather elements at terminals.

APPROACH: The basic method used is the application of Model Output Statistics (MOS). Generalized operator prediction equations for regional areas or, when possible, single-station prediction equations are developed from a record of numerical model output. These statistical prediction equations are then used with operational numerical model predictions to produce automated forecasts.

PROGRESS (July 1975 to October 1976): A new medium-range ceiling/ visibility forecast system will soon be operational. Its major features will be: (1) Six-category ceilings and 6-category visibility forecasts will be generated for both early and final guidance packages. (2) Regionalized prediction equations have been developed for 21 regions encompassing the conterminous U.S. (3) Equations for the early guidance forecasts use predictors from the LFM and surface observations; final guidance forecasts equations include, additionally, predictors from the OE. (4) Three-category combined ceiling/visibility probability forecasts will be extracted from 6-category forecasts. Forecasts obtained by this procedure will be provided 4 times daily to the NMC Aviation Weather Branch and for the Flight Weather Facsimile chart. (5) Threshold probabilities will be used to transform probability forecasts into 'best category' forecasts.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service

5.0023, ELECTRON DENSITY PROFILES APPLIED TO SATELLITE DETECTION/NAVIGATION
R.S. ALLEN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249120)

AF function - advanced radar and navigation systems. Deficiency the ionosphere introduces errors in range, angle and timing in the SPADATS tracking radars, in deep space detection and surveillance radars and in planned navigation systems. Objective - to develop algorithms and techniques for ADC radars so as to reduce system errors caused by the ionosphere. How research contributes - improves the accuracy of radar tracking and navigation systems by developing algorithms and correction procedures. Makes use of on-site measurements and scale factors from worldwide observations collected by Air Force Global Weather Central to specify and update predictions of expected range, angle and timing errors.

Investigate dependence of errors in range, angle and time on the principal parameters of electron density profiles. Develop statistical relationships to predict these from climatology. Develop and validate computer algorithms to use on-site measurements of ionospheric parameters which are useful for real-time and post-event correction to radar and navigation systems.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0024, IMPROVED 10 CM WAVELENGTH WEATHER RADAR
A.W. BISHOP, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249230)

AF function - navigation and detection functions of the strategic, tactical, air defense, and airlift forces. Deficiency - detection capability of weather radar systems in current use is insufficient to detect and identify hazardous zones in storm systems. Objective -develop a 10 cm weather radar with improved characteristics and capabilities. How development contributes - an improved 10 cm weather radar system provides increased detection capabilities, increased detection range and greater reliability of operations for the detection and identification of storm systems. This in-house effort is concerned with the design and development of an improved weather radar system having characteristics comparable to specifications contained in Air Weather Service ROC for an advanced weather radar.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LY, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0025, FALLING SPHERE DENSITY MEASUREMENT
A.C. FAIRE, U.S. Air Force, *Bedford, Massachusetts* 01730 (DF248820)

AF function - ballistic nuclear weapon delivery. Deficiency - missile and decoy trajectories and low-altitude satellite orbits cannot be determined accurately due to inadequate data on temporal and spatial variations of density at critical altitudes. Objective - improved rocketborne falling sphere techniques will be employed to determine atmospheric density between 40 and 170 km. How research contributes -improved capability to calculate accurate ICBM RV and decoy trajectories and low-altitude satellite orbits and reentry.

Atmospheric density will be determined at a number of locations as required. This will include measurements near the reentry corridor at Kwajalein Missile Range using high-precision 7- and 10-inch PZL densitometers (rigid falling spheres) instrumented with unique ultrasensitive triaxially configured piezoelectric accelerometer systems. The sphere payloads will be launched onboard appropriate two-stage sounding rockets. The 7-inch sphere payloads can be used to determine density between 40 and 120 km with medium performance sounding rockets, while the 10-inch payload can determine density between 40 and 170 km. This is a unique capability that will be essential for comparing rocketborne density data with observations from onboard satellite instrumentation such as the SSD package on the DMSP satellite. A significant part of the effort will be directed toward improving the accuracy and reliability of both the 7-inch and 10-inch falling sphere systems. The 10-inch PZL densitometer is operational but is continually being upgraded with new state-of-the-art electronic technology. More work is required to develop an operational 7-inch PZL densitometer that will provide a more cost-effective system for high-precision density measurements up to 120 km.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LK, L G Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0026, OPERATIONAL WEATHER TECHNIQUES
P.J. PETROCCHI, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF254490)

AF function - observing and forecasting the environment in direct support of strategic and tactical operations. Deficiency - operational effectiveness of weather instrumentation is not suffi-

cient to meet operational support requirements. Objective - to develop and evaluate new weather radar data processing techniques for operational use. How development contributes - provides a more reliable means for the identification and forecasting of hazardous weather.

The unique capability of the weather radar processor and color display which can play-back up to 40 complete PPI presentations will be fully exploited in the development of operational techniques with conventional weather radars and Doppler radars. The basic system capability will also be expanded to enable processing of other pertinent weather radar data such as vertical liquid water content and CAPPI to provide positive recognition of present or approaching severe weather.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LY, L G Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0027, ELECTRIC FIELDS IN THE IONOSPHERE AND MAGNETOSPHERE

M. SMIDDY, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249360)

AF function - surveillance, communication, navigation, ionosphere and magnetosphere modeling. Deficiency - environmental electric fields produce plasma motions which degrade orbital prediction and tracking accuracy as well as limiting the use of velocity vector sensors for satellite and missile guidance systems. They also cause irregularities which seriously degrade electromagnetic propagation prediction progress. Nuclear burst debris is diffused by electric fields, modifying the radio blackout observation of the burst. Objective - FY77 - new instrumentation will be developed for environmental electric field and vehicle potential measurements at synchronous altitude and at rocket altitudes in the auroral zones. Analysis of results from past rocket flights will be completed, integrated with simultaneous particle and optical emission measurements, and prepared for publication. How research contributes - models of electric fields and currents in the ionosphere and magnetosphere will significantly improve AF prediction capability of electromagnetic propagation and nuclear burst debris radio blackout conditions. It will minimize errors in satellite and missile ephemeris and tracking prediction and will define operational and design parameters for velocity vector guidance sensors.

Electric field measurements carried out by means of rockets and satellites and analytical studies are carried out based on the results of these experiments. The global f-region electric fields will be mapped and the influence of electric fields on spacecraft charging determined.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0028, APPLICATION OF LUNAR LASER RANGING DATA TO A STUDY OF PLATE TECTONIC DRIVING FORCES

S.C. SOLOMON, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (NSG 7329)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0029, TEMPERATURE DEPENDENCIES OF ELECTRONIC TRANSITION ENERGIES OF HEATED LUNAR MATERIALS

R.G. BURNS, Univ. of Michigan, Graduate School, *Ann Arbor, Michigan* 48104 (NSG 7338)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0030, WIND AND TEMPERATURE EXPERIMENTS FOR SAN MARCO D

G.R. CARIGNAN, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (NAS 5-24135)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0031, FOREST LAND APPRAISAL FROM SERIAL PHOTOGRAPHS

C.E. OLSON, Univ. of Michigan, School of Natural Resources, *Ann Arbor, Michigan* 48104 (0070625; MICY00093-F)

OBJECTIVE: Determine the feasibility of using air photos as primary data source for implementing and extending the Michigan Land-Cover Classification Scheme as a unified basis for forest land appraisal in Michigan.

APPROACH: Michigan has recently promulgated a four-level Land-Cover Classification Scheme and projected that detailed information required at Levels III and IV will require extensive groundwork. It is hypothesized that careful measurement of tree height, crown diameter, and stand density can reduce the amount of groundwork required and permit extension of the scheme to include preliminary estimates of land value. Photo measurements for test sites in four counties will be compared with ground measurements of the same sites to test this hypothesis. Use of sequential photography to assess change over a several-year period and refine estimates of site quality is planned. Cost effectiveness of different scales of photography in such appraisals will also be investigated.

SUPPORTED BY Michigan State Government

5.0032, ENVIRONMENTAL INVENTORY AND ASSESSMENT IN THE YAZOO BACKWATER AREA, MISSISSIPPI

D.C. GUYNN, Mississippi St. University, School of For. Resources, *Mississippi State, Mississippi* 39762 (0070285; MIS-0812)

OBJECTIVE: Conduct an inventory of fish and wildlife resources in the Yazoo Backwater Area. Assess the effects of the Yazoo Backwater Pumping Project on fish and wildlife populations and habitats.

APPROACH: Current land-use patterns, ownership categories, gross wildlife habitat types, and environmental features will be determined by use of infrared imagery and ERTS Satellite Computer Image. Spot field observations will be made to insure accuracy of data. Special attention will be given to areas considered as critical habitat for threatened or endangered species. Potential threatened or endangered species will be identified using established lists. Assessment of project impact on areas of critical habitat will be made. Sites for project structures, changes in periodic flooding levels and projected changes in land use will be primary considerations. Management programs and techniques to enhance and preserve these areas will be formulated where possible.

SUPPORTED BY Mississippi State Government

5.0033, CHARACTERIZATION OF VEGETATION AND DRAINAGE IN STRIP-MINED LANDS UTILIZING REMOTE-SENSING TECHNIQUES

C.J. JOHANNSEN, Univ. of Missouri, Agric. Experiment Station, *Columbia, Missouri* 65201 (0071419; MO-684-15-20)

OBJECTIVE: Characterize vegetation and drainage patterns of representative strip-mined areas to evaluate reclamation methods. Extend information to larger areas by remote-sensing techniques. Provide information in format usable by reclamation authorities.

APPROACH: Study sites will be selected from three different surface mining stages: Pre-1950, 1950-1972 (surface mining law passed) and 1972 to present. Study sites will be flown at different seasons of the year to evaluate surface cover. Current photography using four film types plus previous photography will document revegetation success. Random 1000 square meter quadrants will be ground-truthed identifying species composition and density. Photographs will be digitized and analyzed by computer utilizing pattern recognition techniques. Assessment will be made of vegetation density. LANDSAT images will also be analyzed over selected areas. Drainage patterns and their influence on reclamation methods will be evaluated. Results will be provided to Extension Service personnel to be utilized in educa-

tional programs as well as work by State Reclamation Commission.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Missouri

5.0034, TURBULENCE DYNAMICS AND PREDICTABILITY

R.H. KRAICHNAN, Unknown Inst. or Indiv. Grant, *New Hampshire* (ATM75-15100 A01)

The objective of this research is the application of analytical turbulence theory and statistical physics to the properties of turbulent flows of meteorological relevance. Emphasis will be on the following: (1) Sub-grid-scale representations - work will continue on improving or replacing conventional methods of accounting for motions smaller than the grid size in numerical calculations; (2) Predictability studies continued efforts to formulate and use new measures of the growth of prediction error; (3) Dynamics of 2-dimensional turbulence - continued study of basic atmospheric turbulence with particular emphasis on the transfer of energy to larger spatial scales; (4) Compacted models of the full equations of fluid motion - an effort to optimize the numerical solution of the Navier-Stokes equation so that computations are minimized for results of given accuracy.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0035, ELECTRICAL STRUCTURE OF THE MIDDLE ATMOSPHERE

R.O. OLSEN, U.S. Army, Atmospheric Sciences Lab., *Las Cruces, New Mexico* 88002 (DA0D2297)

The technical objective is to obtain experimental data of the electrical structure of the middle atmosphere (10-110 km). The measurements will consist of electron densities and ionic conductivities, densities and mobilities. The data will be utilized to provide an understanding of the processes which effect the ionization of this region and for the validation of predictive codes and models used for determining the atmospheric effects upon military systems and operations.

Ground-based, balloon-borne and rocket-borne sensing techniques will be utilized to provide measurements of the electrical structure. The ground-based techniques will include ionosphere sounding equipment, the balloon instrumentation will consist of an ion mass spectrometer and ion conductivity probes. The rocket-borne probes are to consist of Gerdien condensors, ion conductivity, and electron density probes. The measurement will be made at WSMR, New Mexico, and at Poker Flat, Alaska, in conjunction with other related measurements.

ADDENDA: Supporting agency address is: ECOM Atmospheric Sciences Laboratory, DRSEL-BL-D, White Sands MR, NM 88002

SUPPORTED BY U.S. Dept. of Defense, Army

5.0036, MINERAL CRYSTAL CHEMISTRY AT HIGH TEMPERATURE AND PRESSURE

J.J. PAPIKE, State University of New York, Graduate School, *Stony Brook, New York* 11790 (EAR73-00501 A02)

This is a continuation of research supported under NSF grant A041137.

This project involves investigation of the crystal structures and chemical bonding in rock-forming silicates and related minerals. The work will concentrate on the crystal structures and chemical reactions of pyroxenes and related minerals. Particular emphasis will be given to: (1) the study of ferrosilite phase transitions; (2) the high-temperature crystal chemistry of pyroxferroite, K-feldspar, and scapolite; (3) crystal chemistry and bonding in sulfide minerals. New projects will include high-pressure X-ray diffraction studies, development of theoretical models for high-pressure phases, and re-evaluations of the chemistry of the pyroxene and amphibole mineral groups. The data will provide fundamental information about the nature and origin of rock-forming minerals and will help determine their conditions of formation in lunar and terrestrial rocks.

SUPPORTED BY U.S. National Science Foundation, Div. of Earth Sciences

5.0037, EFFECTS OF PINE BEETLE INFESTATION

T.E. MAKI, Univ. of North Carolina, Agric. Experiment Station, *Raleigh, North Carolina* 27600 (0069786; NC-PB5)

OBJECTIVE: Determine possible interrelationships of southern pine beetle infestation and associated mortality among four pine species and major environmental factors such as soil type, geologic origin of soil parent material, land use history, site quality, species mixtures, stand origin, etc., as found within the flood zone of upland soils along the 836-mile Kerr Lake perimeter.

APPROACH: Initially an air photo reconnaissance of the shoreline zone will be made to detect spots of infestation; then by overlays of existing soil and geologic formation maps, possible ocular correlations of existing infested spots with major environmental factors will be determined. Regardless of the outcome from gross overlay procedures, ground examination of the infested spots and adjacent uninfested spots will be undertaken for subsequent statistical analysis of detailed data on environmental factors.

SUPPORTED BY North Carolina State Government

5.0038, DISTRIBUTION AND PROPERTIES OF LOESSIAL DEPOSITS IN EMMONS COUNTY, NORTH DAKOTA

B.K. WORCESTER, North Dakota State University, Agric. Experiment Station, *Fargo, North Dakota* 58103 (0067892; ND04528)

OBJECTIVE: Determine the source, extent, distribution and properties of the loess in Emmons County, North Dakota.

APPROACH: Field locations will be selected throughout the county and thickness determined by drilling. Representative samples will be analyzed for particle size distribution, pH and calcium carbonate content. Vectorial alignment of the thickness of the deposits and the measured properties will be used to establish the most probable source area.

PROGRESS: The probable source of the loess has been identified as the flood plain of the Missouri River. Observations indicate that very localized sources have also contributed. The loess has been worked since deposition. In excess of 250 thickness measurements have been made and a first approximation of a loess thickness map has been constructed. False color composite LANDSAT imagery has been used as a base map. Samples have been taken for laboratory analysis.

SUPPORTED BY North Dakota State Government

5.0039, THE PACIFIC NORTHWEST REGIONAL COMMISSION'S LAND RESOURCE INVENTORY TASK FORCE - AN OVERVIEW DOCUMENTATION IN 35MM SLIDE FORM

B.J. SCHRUMPF, Oregon State Higher Educ. Sys., Environ. Remote Sensing Lab., *Corvallis, Oregon* 97331 (NCA 2-586701)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0040, DEVELOP A TWO-DIMENSIONAL NUMERICAL MODEL TO TEST THE RELATIONSHIP OF RAPID MESOSPHERIC WARMINGS TO INTENSE TROPOSPHERIC CONVECTION

J.H. CLARK, Penn. State University, School of Earth & Min. Sci., *University Park, Pennsylvania* 16802 (NAS 6-2818)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0041, USES OF AERIAL PHOTOGRAPHS IN VARIOUS FORESTRY ACTIVITIES

W.A. SHAIN, Clemson University, Agric. Experiment Station, *Clemson, South Carolina* 29631 (0060546; FR00004)

OBJECTIVE: Develop keys for identifying tree species on aerial photographs. Construct aerial volume tables for selected timber species in South Carolina. Develop from aerial photographs management aids in the form of specialized topographic maps, vegetation maps, and stand delineation maps. Develop

methods of measuring the influence of forest waters - surface runoff, standing surface water, and soil moisture - on the silvicultural characteristics of the forest.

APPROACH: Aerial photographs - panchromatic, infrared, color, and color infrared - will be used at selected scales during the autumn, winter, and spring seasons. Dichotomous keys will be used, utilized in tree identification. Electronic data processing machines will help reduce the field data of aerial volume tables. Sample plots located and measured on both the ground and the aerial photographs will supplement work on water levels, delineation maps, and aerial volume tables.

PROGRESS: Former graduate student, James G. Williams, Jr., presented a paper 'Identifying under-story vegetation from aerial photographs on the Hobcaw Forest' at the American Society of Photogrammetry symposium in Athens, Georgia. Proceedings for this symposium are scheduled for publication in February, 1976. Graduate student, Charles Stephen Newman, is completing work on his thesis 'The effective incorporation of aerial photographic interpretation in land-use planning.' Much of this work deals with finding the most efficient combination of scale, film type, and season to provide the effective land-use input data.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, South Carolina

5.0042, LABORATORY STUDIES OF THE DIFFUSE REFLECTANCE SPECTRA OF FROSTS AND MINERALS OCCURRING ON ASTRONOMICAL OBJECTS
F.M. GLASER, Pan Amer. University, Graduate School, *Edinburg, Texas* 78539 (NSG 7298)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0043, UPPER ATMOSPHERIC STUDIES USING COMBINED INCOHERENT SCATTER, PHOTOMETRIC, AND SATELLITE BORNE MEASUREMENTS
H.C. CARLSON, Univ. of Texas, Center for Space Sciences, *Richardson, Texas* 75082 (ATM76-80208)

This grant funds a theoretical and experimental study of the ionosphere in three main areas: ionospheric heating experiments, F-region electron energy balance, and thermospheric dynamics. These studies will use data taken at the National Astronomy and Ionosphere Center at Arecibo, Puerto Rico, together with theoretical work in both plasma physics and molecular kinetics.

Particular problems to be addressed include: 1. a determination of the cooling rate of thermal electrons to atomic oxygen, 2. a direct measurement of the effective lifetime of O(1D), the O(1D) quenching coefficient, and the O(1D) excitation efficiency, 3. a measurement of the temperature dependence of the O2 e reaction, 4. a study of the processes by which the HF heating facility at Arecibo produces fluxes of superthermal electrons, and 5. a study of the observed nighttime thermospheric bulge that is currently not explained by existing models.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0044, LIQUID PHASE OZONE IN FREON GAS
UNKNOWN, Utah Higher Education System, Graduate School, *Logan, Utah* 84321 (NAS 2-9557)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0045, SPECTRAL AUTOCORRELATION FOR FEATURE EXTRACTION FROM AERIAL PHOTOGRAPHY
R.D. LEIGHTY, U.S. Army, Engineer Topographic Labs., *Fort Belvoir, Virginia* 22060 (DA0M8065)

The autocorrelation function of the spatial frequency spectrum will be investigated for potential application to automated feature extraction from aerial photography. It is anticipated that the study will show that this function can be used in automated feature extraction as is the optical power spectrum, but without detrimental phase effects due to emulsion thickness variations and base inhomogeneities. A useful application would be in the topographic field.

The optical power spectrum analysis approach to feature extraction and image quality prediction can have its results corrupted by emulsion relief and base materials. This analytical and experimental research study will develop the concept and applicability of spectral autocorrelation to remove these limitations.

ADDENDA: Supporting agency address is: OCE Center for Coherent Optics, RI, USA Engineer Topographic Laboratories, Ft Belvoir, VA 22060

SUPPORTED BY U.S. Dept. of Defense, Army

5.0046, A LAGRANGIAN ANALYSIS OF THE SURFACE FEATURES OF THE KEWEENAW CURRENT
T. GREEN, Univ. of Wisconsin, Inst. for Environmental Stud., *Madison, Wisconsin* 53706 (OCE76-82563)

The Keweenaw Current is an important component of the circulation in Lake Superior. During the summer of 1973, a very dense set of Lagrangian surface current measurements was acquired over a four-day period. These data were supplemented by data from moored current meters, bathy thermograph cross sections of the Current, and surface thermal maps of the entire Current from airborne radiometer measurements. This project will continue and complete the analyis of these data.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, SPACE PROCESSING OF BIOLOGICAL MATERIALS
W.L. GIBSON, Alabama Agric. & Mech. Univ., School of Arts & Sciences, *Normal, Alabama* 35762 (NSG 8051)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

6.0002, PROPERTIES OF THE FLAGELLAR MEMBRANE OF CHLAMYDOMONAS
A. GIBOR, Univ. of California, School of Letters & Science, *Santa Barbara, California* 93106 (NCA 2-680702)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

6.0003, SIMULATION OF SPACE FLIGHT-INDUCED METABOLIC CHANGES BY UNDERNUTRITION
T. FAST, Univ. of Santa Clara, School of Science, *Santa Clara, California* 95053 (NCA 2-685709)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

6.0004, ROCK-INHABITING MICROORGANISMS FROM HOT AND COLD DESERTS - ADAPTATIONS TO EXTREME ENVIRONMENTS
E.I. FRIEDMANN, State University of Fla. Sys., School of Arts & Sciences, *Tallahassee, Florida* 32306 (NSG 7337)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

6.0005, EVALUATE SURFACE TEXTURING, BY ION BEAM SPUTTERING, OF ORTHOPEDIC ALLOYS (ABBREV)
D.F. DIBBONS, Case Western Reserve Univ., School of Engineering, *Cleveland, Ohio* 44106 (NSG 3151)

Evaluation of surface texturing, by ion beam sputtering, on the mechanical fixation and biological compatibility of orthopedic alloys.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

6.0006, EFFECT OF BRAIN TISSUE OXYGEN LEVELS ON HUMAN OPERATOR PERFORMANCE
A.T. KISSEN, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322440)

The objective of this work unit is to describe and quantitate in human analogs, by invasive or non- invasive techniques, the impact of altered breathing gas environments on cerebral function/human operator performance. Applications of findings in this work unit include (a) validation and justification for use of non-invasive techniques in place of invasive procedures for subsequent human experimentation, and (b) data input to a cerebral oxygenation-operator performance model.

Accomplishment of the objective is dependent upon execution of various technology-based experiments. (1) Studies involving cerebral oxygenation of non-human primates under g stress invoive relatively short time sampling periods. The use of polarographic oxygen probe with rapid response time characteristics must be preceded by its evaluation against the standard mass spectrometer membrane. (2) Use of non-human primates on the DES in physiologic and performance-related studies will require a DES animal platform modification to accommodate mass spectrometer analyzer and a performance display/data acquisition unit.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab EM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0007, WEAPON DELIVERY INTERFACES FOR ADVANCED FIGHTER AIRCRAFT
P.V. KULWICKI, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321140)

Develop human engineering criteria for improved weapon delivery from advanced technology aircraft. During FY 77, the specific objectives are: (1) identify key weapon delivery interfaces (control/display concepts, presentation formats, event timing, etc.) contemplated for advanced technology aircraft and determine the adequacy of existing criteria for crew integration and (2) describe the nature of weapon delivery opportunities associated with the use of advanced technology air-to-air missiles. The need for this effort arises from the following factors: (1) recent trends in aircraft design toward greater maneuverability have led to more fleeting air-to-air weapon opportunities resulting from a much lower frequency of conventional tailchase situations, (2) increased cost of armament demands of higher success per round expended, (3) the need to penetrate heavy defenses argues for a single pass strike ability, (4) attack missions at night and in marginal weather require high crew workload, and (5) the level of automation needed for weapon delivery from advanced technology aircraft has not been established. Inasmuch as crew effectiveness is paramount for weapon delivery, improved human engineering criteria will directly support the AFSC development goals TC-2, TC-5, and MS-4 as well as ASD TN 72-46 (high acceleration cockpit) and the draft requirement TAF-301-73 (advanced tactical fighter).

The major FY 77 objectives will be satisfied by (1) the acquisition and review of tactical planning documents, mission analyses, technology studies and configuration studies with emphasis on a 1982 technology state-of-the-art for tactical weapon delivery--the product of this effort will be an informal analyses report (annually revised) which will document projected mission trends and identify gaps in the availability of interface criteria to aid in planning further developments, and (2) detailed analysis of an existing data base of simulated air combat wherein advanced missiles were used in a broad spectrum of man-in-the-loop tests from a variety of advanced technology aircraft.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0008, MODEL OF SECOND STAGE SIGNAL PROCESSING FUNCTION OF AUDITORY SYSTEM
T.J. MOORE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321470)

This effort has as its goal the development of innovative data processing techniques. These techniques are needed to handle, on a real-time basis, the wealth of data generated by Air Force reconnaissance and communications systems.

This work unit will transition the results of neurophysiological studies done under 2312-V4-15 and 2312-V3-10 into networks tested on the CXC computer. These test networks provide means of evaluating the various parameters manipulated for feature extraction in an innovative signal analysis system.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0009, DEVELOP NOISEFILE 2 AND EXPAND/UPDATE NOISE DATA HANDBOOK TO DEFINE AIRBASE/COMMUNITY NOISE
J.D. SPEAKMAN, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321400)

The AMRL Noisefile (developed under work unit 72310425) contains the aircraft flight and ground runup noise data required as input to the Noisemap environmental noise exposure predictive program. The USAF Noise Data Handbook (developed under 72310418) includes the data needed by bioenvironmental and civil engineers for defining/ resolving on-base and surrounding community noise problems from ground runup operations. It is essential that both Noisefile and the Noise Data Handbook be continuously expanded/updated to include data on aircraft currently in inventory as well as new systems as they are developed. This is critical for: (1) Air Staff/MajCom/SPO beddown/deployment, environmental noise impact, and compatible land use studies using the Noisemap computerized procedure, and (2) Airbase/MajCom local facility siting and ground runup noise assessment studies using the Noise Data Handbook.

Instrumentation, test protocols, and data reduction techniques previously developed by AMRL will be used to maintain continuity with the prior data acquired and analyzed on over 40 aircraft.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0010, LOUDNESS BALANCE METHOD OF EVALUATING HEARING PROTECTORS
M.R. STEPHENSON, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321300)

The hearing protection features of helmets, headsets and hearing protectors are currently evaluated using standard methods that employ very low-level signals. Evaluation procedures that use high-level test signals may provide more valid estimates of protector performance in intense noise fields. The objective of this work unit is to assess the validity and accuracy of a suprathreshold loudness balance method of evaluating hearing protectors. Current hearing protector evaluations conducted by the AF employ the standard ANSI real ear attenuation at threshold (REAT) method as the test instrument to define hearing protector performance. This work unit will evaluate the relative merits of the loudness balance method to determine which method is the most effective procedure for predicting performance of hearing protectors relative to procedures identified in AFR 161-35.

Human subjects will balance the loudness of narrow bands of noise, presented through loudspeakers, with a 1 kHz pure tone presented through an ear insert receiver. Measurements will be

conducted with the subjects' alternately having their test ear exposed to the noise bands and being occluded by ear muffs. Preliminary data indicate the loudness balance method and REAT method result in considerably different hearing protection values. The experimental procedure will attempt to identify the reason(s) for these differences through a systematic manipulation of the independent variables. This effort will provide technology to be used to validate or to recommend changes to current estimation procedures.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0011, SELF-REGULATORY CONTROL OF AIRCREW EXTREMITY TEMPERATURE

E. HENDLER, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974 (DN681225)

To determine the effectiveness of self-regulatory control of hand temperature in the cold in improving performance without compromising body heat content. This work unit is responsive to new research needs indicated in the FY-74 Naval Aviation Biomedicine/Human Effectiveness Technical Workshop Report.

Subjects dressed in pilot's protective clothing will be trained to self-regulate the temperature of their hands under cold environmental conditions. Standard dexterity tests will be administered to quantitate performance, and body temperature measurements will be made to determine the extent of body heat loss. Conclusions regarding the duration and extent of self-regulating skin temperature changes in the cold will then be drawn.

ADDENDA: Supporting agency address is: Naval Air Systems Command Research and Technology, Washington, DC

SUPPORTED BY U.S. Dept. of Defense, Navy

6.0012, ADVANCED DESIGN CONCEPTS FOR ANTI-G SUITS/VALVES

R.R. BURTON, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322320)

To design, fabricate and test experimental anti-g valves and suits which can be used to improve g protection during exposure to aerial combat-type maneuvers.

An electronic variable flight-worthy anti-g valve (designed under 7930-03-51) will be fabricated in house. Optimal anti-g suit pressurization schedules will be determined using the SAM centrifuge (evaluation criteria to be established in 7930-12-07) and during aerial combat maneuvers using high-performance fighter aircraft. Pneumatic level experimental anti-g suits (designed and fabricated under 7930-03-51) will be tested as an advanced design concept using the SAM centrifuge (evaluation criteria to be established in 7930-12-07). Successful suit and valve candidates will be handed off to 7930-12-XX to be fabricated as advanced experimental models and to be tested under 7930-12-XX (valve test) and 7930-12-XX (suit test).

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0013, BIOMEDICAL STANDARDS ON TACTICAL MISSION/AIRCREW EMPLOYMENT FOR REPEATED HIGH G EXPOSURES

K.K. GILLINGHAM, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322560)

To provide recommendations for a safe envelope of operational exposure to extended and repeated high plus gz stress in aerial combat manuevering, and to determine practical means by which that envelope can be expanded.

Physiologic monitoring of human centrifuge riders and of pilots flying high-performance fighter aircraft will be carried out during exposure to plus gz stresses of the intensity, duration, and repetitiveness expected during aerial combat. Evidence of physiologic strain will be ascertained, and points of physiologic failure, such as zero eye-level blood pressure and flow, and substantially decreased blood oxygen saturation, will be identified in relation to the g-stress characteristics. Predictive descriptions of the physiologic deterioration under g stress will be obtained mathematically. Statistical analysis of data relating improvement of g tolerance to various physical conditioning regimens will be accomplished; other varieties of g-tolerance-improving training and conditioning procedures having operational merit will be tested and evaluated. Unfinished efforts begun under work unit 7930-03-49 will be completed under this work unit.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0014, CREW RATIO REQUIREMENTS FOR UPGRADED/ADVANCED JET TRANSPORT FLEET

H.M. HUGHES, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322160)

The effect of aircrew management policies on operations is complex due to the many factors involved and the interaction of the various factors. Optimum values of aircrew manning and handling can be evolved through actual operations but a a great cost in time and noneffectiveness. Furthermore this approach cannot solve the problem of anticipated conditions not yet experienced. Efforts under this work unit will provide supportable estimates of optimum aircrew manning under anticipated airlift operational conditions, with primary attention to upgrades and advanced concepts of the jet transport fleet.

A computer simulation program, developed at USAFSAM, which focusses on the aircrew aspects of airlift operations, will be used to simulate operations of the upgraded/advanced jet transport fleet. Effects of upgrades and innovations on the required manning will be explored and analyzed. Validity of the parameters used in these simulations will be verified by selected studies.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine BR, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0015, WINDSCREEN EVALUATION - F-111 AND GENERIC

W.F. PROVINES, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321960)

High-performance aircraft windshields designed to withstand bird impact have evolved into thick, curved, laminated new materials compositioned transparencies of large dimensions. This effort will provide optical measurements and visual performance capabilities of trained observers through a variety of segments and full-scale windshields characteristic of USAF inventory and emerging aircraft. Test results will provide scientifically based tolerance values for windshield specification writers and guidance to windshield manufacturers on realistic quality control measures.

An optical laboratory has been established. The facilities and equipment provide capability for accurate determinations of transmission, haze, deviation, distortion and multiple image production for any aircraft windshield provided for study. Visual performance testing in the physiological optics laboratory can be conducted on acuity alteration, stereopsis changes, and eikonemetry (magnification) effects produced by transparencies with known optical defects. Coordination with AMRL personnel engaged in related optical-visual performance studies will be maintained. Efforts previously documented under work unit 7755-09-01 and 7755-09-04.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0016, AIRCREW SYSTEM OPERATOR PERFORMANCE SIMULATION

D.M. SCHOLL, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321560)

An essential component for any survivability/vulnerability (s/v) assessment of manned USAF systems is a reasonable estimate of the likelihood and severity of performance decrement that aircrews might suffer when exposed to weapons radiation in operational environments. The objective is to provide data from which such reasonable estimates can be derived. Nonhuman pri-

mates, trained to perform visual tasks, analogous to aircrew duties in both their type and scheduling, will be examined performing under conditions of radiation alone or radiation combined with other environmental stressors. The measurement of primate performance in such situations will allow more accurate prediction of human aircrew performance by supplying necessary data to currently developing mathematical models of manned system s/v.

By employing established psychological procedures, nonhuman primates will be trained in existing analogs of complex aircrew duties and in new tasks to be developed. The tasks will require considerable attention/vigilance to visual stimuli of both continuous and intermittent varieties. Continuous performance in compensatory and pursuit visual tracking tasks will be used to simulate aircrew tasks such as the navigational duties of an offensive system operator (OSO). Detection of signals in various levels of noise will simulate pilot, OSO, and other aircrew members' requirements to monitor instrumentation. Primate short-term memory for visual stimuli will provide some basis for predicting decrement of crew member psychological functions beyond simple perceptual- motor skills. Radiation exposure and additional stressors will be designed to fit hypothetical operational situations.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine RA, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0017, FOLLOW-UP OF A LIGHTWEIGHT AIRCREW HELMET

R.L. STORK, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322620)

During FY 77, OT&E of a new, lightweight, aircrew, flight helmet will occur during the AIMVAL/ACEVAL exercise. Four prototype helmets will be rated by the aircrews during the exercise. The objective of this work unit is to follow the OT&E monitoring the experience gained with the helmet.

OT&E data will be used to compile a technology base from which biomedical criteria may be established for application to future aircrew protective headgear production programs.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, ACCELERATION OF IMPLICIT FINITE-DIFFERENCE ALGORITHMS FOR CONVECTION EQUATIONS

J.C. TANNEHILL, Iowa State Univ. of Sc. & Tech, School of Engineering, *Ames, Iowa* 50011 (NCA 2-340706)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

7.0002, NUMERICAL ANALYSIS OF MUZZLE FLOW 14369-E

G. MORETTI, Polytechnic Inst. of New York, School of Science & Engin., *Brooklyn, New York* 11201 (DA0F8919; DAAG29 77 G0072)

To perform a numerical analysis and develop computational techniques for describing transient gas discharges characteristic of muzzle flows. Relevance - the investigation is directly relevant to the investigation of muzzle flows at both BRL and PA. Results of the investigation will assist in research into weapon accuracy, crew safety, firing signature, and artillery vulnerability.

Novel computational techniques are proposed which will include the use of sophisticated grids generated by conformal mapping, proper handling of all boundary conditions, second order integration schemes and fitting of all discontinuities.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense, Army

7.0003, NUMERICAL ANALYSIS AND MACHINE COMPUTATIONS

P.J. NIKOLAI, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF136330)

Computational algorithms are necessary for improved analysis and simulation of performance in the development of complex weapons and delivery systems, but in many cases the algorithms are unavailable, and in others they are inadequate. The goal of this work is to develop practical, effective and efficient algorithms for the solution of numerical problems arising in typical computing tasks which occur repeatedly in different settings. Research is concerned with more accurate and efficient solution of the algebraic eigenvalue problem and the solution of large systems of linear algebraic equations, both basic computations in the analysis of loading of flight vehicle structures. This work leads naturally to wide-ranging consulting activities in regard to implementing computer algorithms, to efficient use of available computing resources and to procuring additional computing resources should this prove desirable.

The computational algorithms selected for analysis and implementation are determined by requirements arising within the task and by needs communicated through consulting activities within the laboratory as a whole. A given computational requirement may be satisfied by various competing methods. Algorithms arising from these methods are analyzed and evaluated for possible implementation as subroutines for available digital computers. These studies emphasize the extension of existing theory and the development of new algorithms when a realistic survey of existing methods reveals deficiencies either in performance or documentation.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBRD, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

7.0004, COMPUTER ENGINEERING INVESTIGATIONS FOR THE AFAMRL

L. CRUM, Wright State University, School of Science & Engin., *Dayton, Ohio* 45431 (DF047820; AF-AFOSR-3244-77)

AF function - human operator performance is of central importance to USAF manned weapon system effectiveness. There is an immediate need for research on the effects of motion and operation environmental stresses on the air crew member, to improve air-to-air attrition programs and to improve design of motion base simulators within the Air Force. Deficiency - research is needed to evaluate the human operator subsystem and the effects of environmental stress on performance. An analytical description of the operator is needed to replace manned simulation and costly flight tests for each new weapon system. Objective - this work proposes to extend preliminary work recently conducted at AMRL on the investigation of computer simulation and analysis of nonlinear systems. How research contributes - this work should provide significant contribution to ongoing and planned work at AMRL dealing with the applicability of appropriate mathematical techniques toward the study of human operator performance. It contributes directly to sub-area 1.10, 'human operator performance modeling techniques'.

The research proposed endeavors to mathematically model human operator performance and to verify the model's applicability in a variety of tracking situations.

ADDENDA: Supporting agency address is: AF Office of Scientific Research XO, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

7.0005, PRACTICAL METHODS FOR THE COMPENSATION AND CONTROL OF MULTIVARIABLE SYSTEMS

P.L. FALB, Brown University, Graduate School, *Providence, Rhode Island* 02912 (DF046610; AF-AFOSR-3182-77)

AF function - a study of control methods for high-performance aircraft, helicopters and ballistic missiles. Deficiency -

compensation and control of the above systems. Objective - the primary objective of this research effort is the development of practical methods for the compensation and control of multivariable systems. How work contributes - success in this area would facilitate the design of Air Force systems as well as their control systems.

The proposed research can be divided into three areas of consideration. First, effort will be devoted to the question of pole assignment including a consideration of the maximum number of assignable poles and to the characterization of those 'parts' of a system which remain invariant and those 'parts' which can be freely adjusted via linear output feedback. Second, effort will be devoted to an analysis of certain 'structural' properties of multivariable systems and the influence of various forms of compensation and control upon these properties. Third, effort will be devoted to the determination of conditions under which multivariable systems can be compensated independently of plant parameter variation and perturbations.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, THEORETICAL ANALYSIS OF SCATTERING OF A LASER BEAM FROM ROUGH SURFACES 13913-P

C.C. SUNG, Univ. of Alabama, School of Science & Engin., *Huntsville, Alabama* 35807 (DA0F8901; DAAG29 77 G0051)

To obtain surface characteristics such as roughness, curvature and velocity of an object using the coherent radiation of a laser reflected from the surface. Relevance - the research has direct relevance to ongoing work at MICOM on reentry vehicles and reentry vehicle materials and ECOM on battlefield-surveillance, target acquisition and fire control.

Speckle statistics and the relationship between the average angular irradiance distribution of a reflected laser beam to the surface properties of a random rough surface will be investigated.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense, Army

8.0002, RESEARCH IN THE OPTICAL SCIENCES

P.A. FRANKEN, Univ. of Arizona, Graduate School, *Tucson, Arizona* 85721 (DF046800; F49620-77-C-0021)

AF function - the Air Force functions of surveillance, reconnaissance, communication, command and control, weaponry, navigation and guidance require coherent light generation, modulation, transmission and detection, and optics associated with these applications. This research will address aspects of stabilized sources, theory of integrated optics and advanced optical design. Opportunity - the proposed work consists of three tasks which impact Air Force interests. These tasks are a follow-on to earlier efforts at the University of Arizona so that the Air Force has an opportunity to obtain important results without the necessity of starting brand new efforts. Objective this work will undertake an experiment to greatly reduce the uncertainty of a Michelson-Morley type experiment. It will provide an extension of the theory of waveguides as used in integrated optics. Finally, an advanced approach to optical design will be studied. Contributions -this effort will provide important results to the Air Force on the design of optical elements for all types of applications. It will further the theory, and associated experiments, of optical waveguides for integrated optics applications. Finally, the work will provide techniques for ultra-stable lasers as well as reducing global positioning uncertainty.

The proposed work consists of three specific tasks, all of which impact Air Force interests. The first is a 'one-way' experiment which can be considered as the evolution of a Michelson-Morley experiment. The experiment depends on super-stable lasers so it will advance that technology. In principle, the apparatus will be more sensitive than the Michelson interferometer by four orders of magnitude and will therefore greatly reduce global positioning uncertainty. Finally, the experiment is a physically distinct test of special relativity. The second task is an extension of the theory of waveguides as used in integrated optics. This will include theoretical work on the vectorial ray theory of circular fiber waveguides and experimental studies of diffused guides in lithium niobate and glass substrates. The third task will undertake research in the area of lens design and related areas of geometrical and physical optics. The proposed research involves significant departures from conventional techniques presently used in the optical design process.

SUPPORTED BY U.S. Dept. of Defense, Air Force

8.0003, HIGH-RESOLUTION SURFACE ANALYSIS FOR MATERIALS SCIENCE STUDIES

T.E. EVERHART, Univ. of California, School of Engineering, *Berkeley, California* 94720 (NCA 2-50705)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

8.0004, EXPERIMENTAL AND THEORETICAL STUDY OF II-IV-V COMPOUNDS

C.Y. FONG, Univ. of California, School of Letters & Science, *Davis, California* 95616 (DF044950; F49620-76-C-0016)

AF function - microwave electronic devices are important elements of Air Force communications and countermeasures systems. Opportunity improved performance can be expected from the use of new solid-state materials for the generation and detections of microwave signals. Present microwave solid-state device performance is limited by the properties associated with the structure of the device materials. Objective - the objective of this research program is to determine if the electronic band structure of these materials exhibits sufficiently interesting negative mass states to warrant further investigations of electron transport to ascertain their potential for utilization in solid-state microwave amplifiers and generators. How work contributes these compounds belong to a class of group II-VI-V2 compounds that have a number of interesting physical properties possibly including negative mass charge carriers suggesting potential technological utility, especially for microwave devices. Semiconductors have negative mass charge carriers.

This research investigates experimentally and theoretically the electronic band structure of the anisotropic semiconductors DdSiP2, CdSnP2, CdSiAs2, and CdSnAs2.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

8.0005, FOURIER TRANSFORM INFRARED SPECTRA OF SEVERAL FREONS

R. NANES, Calif. State Univ. & Colleges, School of Math. Sci. & Engin., *Fullerton, California* 92631 (NCA 2-253701)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

8.0006, EXPERIMENTAL STUDIES OF QUASI-ONE-DIMENSIONAL CRYSTALS

P.M. CHAIKIN, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (DMR76-83421)

A primarily experimental study of the transport properties of quasi-one-dimensional compounds as exemplified by the TCNQ salts is being continued. Measurements of the thermoelectric power of these salts give direct information about the interactions which produce their unusual properties. In particular, this group has: (1) shown the importance of, and measured the Coulomb correlation in several TCNQ compounds, (2) measured the amount of cation-anion charge transfer, (3) given an understanding of the band structures, (4) allowed us to associate the conductivity with certain chains, (5) associated these chains with certain

transitions (in TTF-TCNQ) and (6) shown the effect of disorder on the metal-insulator transitions and low-temperature state.

The thermopower of several new organic compounds, especially those which are potentially metallic at low temperature, is being measured. In addition transport measurements (including thermopower) in a magnetic field are being performed to gain more information about correlation effects and Peierls transitions. Finally, 'transverse thermopower' (electric field perpendicular to temperature gradient) and transport in films of these compounds are to be investigated.

This is a continuation of work supported by DMR73-07518. This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0007, CLUSTER VARIATION STUDY OF COHERENT ORDERING IN FCC AND BCC SOLUTIONS 14071-MS

D. DEFONTAINE, Univ. of California, School of Engin. & Appl. Sci., *Los Angeles, California* 90024 (DA0E9281; DAAG29 77 G0002)

To apply the cluster variation method to a number of heretofore intractable theoretical problems in the field of coherent order-disorder reactions in bcc and fcc lattices. The research relevant to Army programs in alloy development, heat treatment of alloys, phase transformations in alloys. As such the research is relevant to problems in development of a whole spectrum of new materials (e.g., clustering in the new amorphous magnetic alloys which may be employed in shielding), as well as the solution of a large number of problems with existing materials (e.g., ordering in commercial nickel-based super alloys such as Hastelloy B, which are employed in aircraft engines).

The program will include (1) computation of coherent ordering phase diagrams, (2) computation of long-range order parameters in the investigated alloy system as a function of temperature, and (3) computation of short-range order parameters (cluster probabilities) in the investigated alloy systems and comparison with X-ray and neutron diffraction data.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense, Army

8.0008, PHYSICS OF ASTROPHYSICAL PLASMAS

UNKNOWN, Univ. of California, Graduate School, *Los Angeles, California* 90024 (NSG 7341)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

8.0009, THE CATALYTIC ACTIVITY OF SMALL PLATINUM PARTICLES SUPPORTED ON SINGLE-CRYSTAL ALUMINUM OXIDE IN LOW-PRESSURE REACTIONS

M. BOUDART, Stanford University, School of Engineering, *Palo Alto, California* 94305 (NCA 2-745717)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

8.0010, THEORETICAL STUDIES OF ELECTRONS IN SOLIDS

W. KOHN, Univ. of California, Graduate School, *San Diego, California* 92037 (DMR76-82422)

Research in the theory of solids with special emphasis on surface-related phenomena previously supported by NSF grant DMR75-02974 A01 will be continued. Four areas of research will be pursued: (1) Surface physics: development of the fundamental theory underlying the density functional formalism: theory of physisorption; indirect interactions between atoms adsorbed on surfaces; scattering of positrons from surfaces to determine the surface dipole barrier potential. (2) Interfaces: dielectric formulation of interface energy; asymptotic perturbation or electron density far from the interface; interface electronic structure by self-consistent moment methods. (3) Generalized Wannier Function: Application to impurity states in semiconductors. (4) Theoretical work on a solar energy (photothermal) system. Surface science continues to be in a state of rapid development, in terms of concepts, new experimental measurements, and theoretical methods. This work will contribute to this development. In addition to its fundamental scientific interest this work will also have impact on such applications as adhesion, grain boundaries, catalysis and solar energy conversion.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0011, THREE-DIMENSIONAL NUMERICAL CALCULATIONS RELATED TO STAR FORMATION

C. HAGAR, Calif. State Univ. & Colleges, School of Natural Sciences, *San Francisco, California* 94132 (NCA 2-660703)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

8.0012, RADIATION AND LASER POTENTIAL OF HOMO- AND HETERO-NUCLEAR RARE GAS DIATOMIC MOLECULES

W.C. WALKER, Univ. of California, School of Letters & Science, *Santa Barbara, California* 93106 (DF046700; AF-AFOSR-3137-77)

AF function - upper atmosphere effects on Air Force operations and advanced short-wavelength lasers. Deficiency - there is insufficient knowledge available of the spectroscopic properties of rare gas continua which occur in the vacuum ultraviolet region of the spectrum. Objective - study spectroscopically the electronic, vibrational and rotational structures of diatomic rare gas molecules. Determine accurate, molecular constants and potential energy curves for the ground and excited states. How work contributes - low-lying electronic states of homo- and heteronuclear rare gas diatomic molecules are of intrinsic importance in understanding long-range forces. In addition, these molecules are also of interest because they are a source of intense vacuum ultraviolet (vuv) radiation and are candidates for vuv laser systems.

For the purpose of studying the homo- and hetero-nuclear rare gas diatomics three spectroscopic methods will be employed - (1) absorption spectroscopy in the vacuum ultraviolet region, (2) emission spectroscopy in the visible and near ultraviolet region. Upper states of assumed bands can be excited by processes such as x x m to x2 m and x2 e to 2x** radiation among others, (3) emission spectroscopy in the vuv region.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

8.0013, CONTROLLED ATMOSPHERE ANNEALING OF ION IMPLANTED GAAS

D.H. LEE, Hughes Aircraft Company, *Torrance, California* 90509 (DF044790; F49620-76-C-0028)

AF function - microwave solid-state electronic devices are essential components of Air Force surveillance, electronic countermeasures and communications systems. Opportunity - microwave devices made from GaAs show great promise for operation in the high-frequency spectrum, and ion implantation promises to be the technique which will create special dopant profiles in GaAs and hence take full advantage of this promising material. Unfortunately, an annealing step is required in order to remove the damage caused by the ion implant, and present-day techniques (especially for n-type dopants) do not adequately provide for high electrical activation of the implanted dopants, protection of the GaAs surface, and protection from contaminants. Objective - the objective of this research is to develop a new annealing encapsulant which will overcome these objections to current techniques. How work contributes - this work will develop a high-purity, flowing hydrogen arsenic atmosphere encapsulation technique in order to achieve high electrical conversion efficiencies, protection of the GaAs surface, and removal of possible contaminants.

N-type dopants (sulphur and silicon) will be ion implanted into hightpurity epitaxial layers of GaAs. The samples will then be annealed using the controlled atmosphere technique (CAT). The CAT for annealing employs a quartz envelope furnace with an inlet flow of purified hydrogen. The hydrogen is passed over a quartz boat containing solid GaAs and a liquid Ga solution saturated with As. This source supplies As to the atmosphere at a pressure near that required for equilibrium with the implanted GaAs surface. The adjustable parameters in the CAT (anneal time and temperature, hydrogen purity, hydrogen flow-rate, and arsenic over-pressure) will be varied in order to minimize surface erosion effects. These surface effects will be characterized both chemically and physically. The electrical conversion efficiency for the n-type dopants as well as the doping profiles and carrier mobilities will be measured by means of hall and capacitance-voltage measurements. The damage profiles after implantation and after CAT anneal will be measured by means of low-energy Rutherford backscattering. Finally, the results of the implanted and annealed profiles will be evaluated in terms of actual device performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force

8.0014, LIGHT SCATTERING STUDIES OF SPIN-FLIP PROCESSES IN SEMICONDUCTORS AND OF ANOMALOUS PHASE TRANSITIONS IN INSULATORS

J.F. SCOTT, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (DMR76-04561)

Experimental studies of ligh scattering in solids previously supported by DMR72-03187 will be continued. The first group of experiments will study structural phase transitions and will emphasize BaMnF4 and TbP5O14. The second group of experiments will be done in the 152kG magnet. These experiments will study magnetic scattering in K2CoF4 and spin flip scattering in wide band gap semiconductors in the II-VI family.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0015, STRUCTURAL PHASE TRANSITIONS IN MOLECULAR CRYSTALS AND FERROELECTRICS

N.S. GILLIS, Colorado State University, School of Science, *Fort Collins, Colorado* 80521 (DMR-18738)

Work carried out under NSF grant DMR72-03202 in the area of structural phase transitions in simple molecular crystals and ferroelectrics will be continued. Two different problems will be studied: (a) molecular monolayer films, typified by molecular nitrogen adsorbed on graphite, (b) more complex ionic molecular crystals such as the inorganic azides, the alkali cyanides and the BaM 2ion F4 isomorphs. The common approach to all these research problems would be the application of primarily lattice dynamical techniques, in some cases supported by molecular dynamics and Monte Carlo studies, to study the coupled librational and phonon modes and their effect on the observed structural phase transitions.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0016, RADIO-FREQUENCY AND LASER SPECTROSCOPY OF BASIC MOLECULES

W. LICHTEN, Yale University, Graduate School, *New Haven, Connecticut* 06520 (PHY75-03264 A01)

The proposed research (in order of priority) is to: 1. Use a continuous-wave, tunable dye laser to study the Doppler-free spectra of the hydrogen molecule.

These studies will include the following investigations: a) to measure the fine and hyperfine structure of both lower and upper states; b) to confirm vibrational assignments of the previously measured fine and hyperfine structure of the lower state (c3Ilu); c) to investigate the energy levels of the 3s sigma and 3d sigma states in order to test the theory of avoided crossings; d) to investigate the possibility of observing triplet-singlet transitions directly. 2) To develop the theory of avoided crossings by both semi-empirical and ab initio calculations of the so and 3do states. 3) To continue investigations of the possibility of studying the fine and hyperfine structure of the (He3)2 and other rare gas molecules; to develop the molecular beam as diagnostic technique for studying electrical discharge and/or flowing after glows. This work is a continuation of that currently supported under NSF grant MPS75-03264.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0017, INVESTIGATION OF NUCLEAR STRUCTURE WITH INTERMEDIATE ENERGY ELECTRONS AND PHOTONS

H.L. CRANNELL, Catholic University of America, School of Arts & Sciences, *Washington, District of Columbia* 20017 (PHY76-81565)

The charge and magnetic distribution of the ground state and excited states of several nuclei will be investigated using the techniques of electron-nucleus scattering. Most of these measurements will be performed using the new high-current and high-resolution energy-loss systems at the NBS and Bates accelerators. These new systems will permit more precise determinations of cross sections than heretofore possible. By comparing the differences in cross sections for electron scattering from sets of nuclei (isotopes and isotones), the effects of adding nucleons to different nuclear shells will be accurately determined. Development of inexpensive high-pressure target cells suitable for high-resolution electron scattering investigations of gases will be continued.

A new program to measure the total and differential cross sections for photoproduction of neutral pions will be undertaken at the Bates accelerator. These measurements will be sensitive to the nuclear matter distribution.

This work is a continuation of that performed under Foundation grant PHY72-04803 A04.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0018, OPTICAL STUDIES OF HIGH-TEMPERATURE A-15 SUPERCONDUCTORS

S. PERKOWITZ, Emory University, School of Arts & Sciences, *Atlanta, Georgia* 30322 (DMR75-13917 A01)

Research under this grant will be a completion of work begun under NSF Grant No. DMR75-13917. Optical measurements in the frequency range from the far infrared to the vacuum ultraviolet will be used to study superconductors with the A-15 crystal structure. These materials, such as V3Si and Nb3Ge, have exceptionally high superconducting transition temperatures and the purpose of this work is to relate the optical properties to the superconducting transition temperature. Far infrared structure between 4 and 25 meV in V3Si has been discovered and there is evidence that it is related to electron-phonon behavior via the Holstein processes. These measurements will be extended to the 1 to 7 eV range so that some band structure data can be obtained. The full range of optical data will be used to seek reliable models to predict the measured variations in the superconducting transition temperature.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0019, THEORY OF THE RESPONSE OF MATERIALS TO ELECTROMAGNETIC RADIATION

J.D. DOW, Univ. of Illinois, School of Liberal Arts & Sci., *Chicago, Illinois* 60607 (DMR76-22352)

Theoretical studies of the soft X-ray, hard X-ray, and optical spectra of materials wil be carried out. The following topics are included: (1) The extraction (from photoemitted electron angular distributions) of empirical atomic pseudopotentials for high-energy (O less than E less than 500eV) photoexcitations of rare gas atoms. These atomic pseudopotentials may be employed in multiple scattering theories of impurities and adsorbates. (2) Attempts to better understand the response of the Fermi sea in a real metal to the sudden creation of a core hole by an X-ray; band-structure, exchange and final-state interaction effects will be evaluated. (3) Studies of the optical properties of solids, namely (a)

extension of the present effective mass theory of impurities in semiconductors to better account for valley-orbit interaction in multi-valley semiconductors, and (b) calculation of the effects of alloying, of impurities, and of intense electric and magnetic fields on the optical spectra of non-metallic solids.

Reference: DMR73-07661.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0020, THEORETICAL PARTICLE PHYSICS

D.G. RAVENHALL, Univ. of Illinois, Graduate School, *Urbana, Illinois* 61801 (PHY75-21590 A02)

Theoretical studies will include work on: 1) Strong interaction phenomenology; 2) Quark confinement; 3) Generalized vector dominance in deep inelastic scattering; 4) Frontier studies in field theory; 5) Scattering of particles from nuclei and nuclear physics.

This work is a continuation of that currently supported by Foundation grant number MPS73-05103 AO1.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0021, THEORY OF INTERACTING FERMI SYSTEMS

A.W. OVERHAUSER, Purdue University, School of Science, *Lafayette, Indiana* 47907 (DMR74-03464 A01)

The program of theoretical research into the problem of electronic interactions in solids carried out under NSF Grant DMR74-03464 will be continued. Part of the program will consist of a theoretical study of physical properties such as the unusual magnetoresistance of potassium and sodium and the unexpected dependence on magnetic field of acoustic wave generation in aluminum and potassium. The thermal resistance of potassium at high magnetic fields will also be studied.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0022, PHONON SPECTROSCOPY IN RARE-EARTH METALS AND ALLOYS

H.A. BLACKSTEAD, Univ. of Notre Dame, School of Science, *Notre Dame, Indiana* 46556 (DMR73-02551 A01)

Research previously supported by NSF grant DMR-7302551 will be continued. A substantially new research effort which will use a 'spin-phonon' spectrometer to examine dynamic magnetoelastic effects in several rare-earth metals, alloys, and intermetallic compounds will be initiated. The principal experimental work will involve the application of a tunable phonon spectrometer to measure the effective phonon temperature and spectral composition of phonons emitted from magnetic samples exposed to a combination of rf and dc magnetic fields. The results obtained from use of the phonon spectrometer will be complemented, as needed, by conventional pulse-echo and microwave absorption measurements on film and crystal specimens. A secondary goal of the research is a determination of the usefulness of these materials as phonon transducers. The magnetostriction of several of the heavy rare earths, notably Tb and Dy, as well as the intermetallic compounds, TbFe2 and DyFe2, is greater by several orders of magnitude than any magnetostrictive material now in use as a transducer. Successful exploitation of these large magnetostrictive effects could lead to extremely important applications which might include high-frequency (200 GHz) laser modulators.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0023, NUCLEAR STRUCTURE RESEARCH

C.P. BROWNE, Univ. of Notre Dame, Graduate School, *Notre Dame, Indiana* 46556 (PHY76-23352 A01)

A broad set of nuclear physics investigations is carried out using a FN tandem Van de Graaff accelerator and ancillary radiation detectors and data handling apparatus.

A major part of the program relies on an ion source of polarized hydrogen beams. Polarization-related experiments will test the structure of bound nuclear states, and details of the (d,p) reaction mechanism.

Direct particle reactions, and evaporation reactions will be used to give spectroscopic data on a wide variety of nuclei. Applicable results will be compared to predictions of nuclear structure models, e.g., the shell model or decoupled rotational band model.

Studies involving heavy ion induced reactions will be initiated. Some of these are expected to exploit higher energy heavy ion beams from the 4MV injector-tandem combined accelerator configuration which is becoming operational.

This work is a continuation of that currently supported by NSF grant PHY76-23352.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0024, LABORATORY INVESTIGATION OF TWO IMPORTANT REGIONS OF THE ATMOSPHERIC SPECTRUM

W.M. BENESCH, Univ. of Maryland, School of Engineering, *College Park, Maryland* 20740 (ATM75-02717 A01)

This grant funds a laboratory investigation of molecular nitrogen photon emissions of atmospheric interest in two spectral regions; the to 2 micron region and the vacuum ultraviolet. These studies will aid in the physical interpretation of data taken during aurora, as well as advancing our basic understanding of molecular spectra. This continues work funded earlier on National Science Foundation grant ATM-7502717.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

8.0025, MEASUREMENT OF INTERSTELLAR HELIUM IMPINGING ON THE EARTH

J.H. MOORE, Univ. of Maryland, School of Agriculture, *College Park, Maryland* 20742 (NSG 5177)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

8.0026, HIGH-ENERGY PHYSICS - SPARK CHAMBER PROGRAM

M.N. KREISLER, Univ. of Massachusetts, School of Arts & Sciences, *Amherst, Massachusetts* 01002 (PHY76-84387)

A study of the properties of the lambda particle will be made in experiments being conducted or planned for at the Brookhaven National Laboratory Alternating Gradient Synchrotron. The program consists of the following parts: 1. Study of lambda beta decay. This experiment is an important one in furthering understanding in the area of weak interactions. Questions such as the validity of the Cabibbo theory and the existence of second class currents will be addressed. 2. Measurements of lambda scattering by protons and nuclei. Measurement of total and elastic scattering cross sections is expected to be proposed. These experiments measure fundamental strong interactions of lambda particles with matter and yield information on the quark structure of baryons.

This work is a continuation of that currently supported by Foundation grant number PHY73-08446 A04.

SUPPORTED BY U.S. National Science Foundation, Div. of Mathematical & Computer Sciences

8.0027, LOW-ENERGY PLASMA MOTION

P.J. WILDMAN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF248940)

AF function - FT77 - communication, surveillance, navigation and ionospheric modeling. Deficiency - inadequate knowledge of bulk motion of ionospheric and magnetospheric plasma inhibits prediction of ionospheric irregularities and density gradients. Objective - use plasma bulk measurements to improve modeling of ionospheric dynamics at all latitudes. Develop improved instrumentation. How research contributes permits prediction of mid-latitude trough and plasma morphology at high latitudes.

Data for PHR experiments on S3 series satellites will be analyzed to determine plasma bulk motions, and their variation with geophysical parameters. Criteria for improving instrumentation will be developed during the examination of the experiment data.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

8.0028, TOPICS IN THEORETICAL OPTICS
R. BARAKAT, Bolt Beranek & Newman Inc., *Cambridge, Massachusetts* 02138 (DF045950; F49620-77-C-0002)

AF function - increased precision in Air Force reconnaissance and detection and greater versatility in communications require advances in optical techniques. Deficiency - basic research in the area of the interaction of electromagnetic radiation and matter is needed. Objective - to carry out a program of theoretical research in the area of the interaction of electromagnetic radiation with matter. Contribution -this research will increase the base of knowledge in the area of electromagnetic radiation.

Theoretical research will be conducted in the following areas: 1) optical diffraction theory, 2) the basic physics of the quantum theory of photoelectron counting statistics, 3) the effect of random mirror defects on laser resonator performance and the diffraction theory of unstable laser resonator configurations, 4) inversion problems that arise in various areas in optical physics, 5) theory of polarization matrices for the description of polarized light propagation through liquid crystals, 6) laser speckle studies.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NP, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

8.0029, DISTRIBUTED FEEDBACK AND GRATING-COUPLED EMISSION LEAD-TIN TELLURIDE DOUBLE HETEROJUNCTION LASER DIODES
C.G. FONSTAD, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (NSG 1413)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

8.0030, IMPURITY AND DEFECT BEHAVIOR IN HIGH-PURITY EPITAXIAL GAAS
C.M. WOLFE, Washington University, School of Engin. & Appl. Sci., *St. Louis, Missouri* 63130 (DF042510; AF-AFOSR-2950-76)

AF function - microwave solid-state electronic devices are essential components of Air Force surveillance, electronic countermeasures and communications systems. Devices made from gallium arsenide show great promise for improved performance and reliability in the microwave region. Opportunity - however, problems, such as current runaway in Gunn devices or excess noise in FETS, have been encountered in GaAs devices. Many of these problems have been attributed to variation of carrier concentration within the epitaxial layer or non-reproducible doping from one layer to the next. Apparently, the behavior of dopants in epitaxial GaAs is not understood at a high enough level to insure expected performance from devices made of this compound semiconductor. Objective - this research effort proposes to advance the understanding of dopants and defects in GaAs. Approach - investigation and identification of electrically-active impurities and defects in high-purity epitaxial GaAs will be made. The interaction of these defects and impurities, and their incorporation into the material as a function of epitaxial growth parameters, will also be investigated.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

8.0031, SURVEILLANCE AND MATERIALS SUPPORT TECHNOLOGY - ELECTRONIC AND MAGNETIC PROPERTIES OF MATERIALS FOR CRYOGENIC DEVICES
P. LINDENFELD, Rutgers the State University, School of Arts & Sciences, *New Brunswick, New Jersey* 08903 (DN775011; N00014-76-C-1064)

The objectives of this task are to study the electronic and magnetic properties of superconducting and non-superconducting materials for use in surveillance and communications devices of interest to the Navy.

This task comprises a variety of experimental investigations in the areas of low-temperature physics, superconductivity, solid-state physics and cryogenics. They include: thermal measurements of granular aluminum films; non-linear electromagnetic response in superconductors; fluctuations in the diamagnetic susceptibility of superconductors containing magnetic impurities; hysteresis of the surface impedance in the mixed state of niobium; uitrasonic studies of magnetic materials and liquid crystals; magnetic resonance studies of the properties of semiconductors and metals and the interactions of ions and vortices in superfluid helium.

ADDENDA: Supporting agency address is: Office of Naval Research Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

8.0032, LOW-TEMPERATURE PROPERTIES OF SOLIDS
P. LINDENFELD, Rutgers the State University, School of Arts & Sciences, *New Brunswick, New Jersey* 08903 (DMR76-22967)

This research program is an extension of that carried out under NSF grant DMR72-03215. It includes the continuation of work in progress as well as the development of areas of investigation which are related to and grow out of recent research results. It includes the following studies: 1. Thermal measurement on granular aluminum films; 2. Magnetic and electric measurements on granular aluminum films; 3. Relaxation time of the superconducting order parameter; 4. Proximity effect; 5. Structural limitations to the phonon mean free path; 6. Flux entry into high-Tc superconductors.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0033, PROBLEMS IN STRONG AND WEAK INTERACTIONS
B. SAKITA, City University of New York, School of Liberal Arts & Sci., *New York, New York* 10031 (PHY77-03354)

Research will consist of four parts: 1) Extended particle model of hadrons. There will be a study of the collective coordinate formalism in Yang-Mills theories, instantons, and quark confinement in a multi-instanton formalism defined on a lattice. 2) Functional integration approach to certain problems in field theory. 3) Work on gauge models, including study of the relevance of higher order loop effects on the mu - e mass ratio. Cabibbo angle, CP violation, etc., study of the relation between pseudo-Goldstone bosons and the hierarchy of boson masses, and work on the consequences of a SU(2)L x SU(2)R x U(1) model. 4) Work on supergravity.

This work represents a continuation of that currently supported by Foundation grant PHY75-07376.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0034, THERMODYNAMIC PROPERTIES OF HIGH-DEGREE PAIR INTERACTIONS
P.M. LEVY, New York University, School of Arts & Sciences, *New York, New York* 10012 (DMR76-82363)

Theoretical investigations of the excitation spectra, thermodynamic properties, and critical phenomena of a particularly interesting class of compounds : the cubic rare-earth compounds, e.g., the rare-earth pnictides will be continued. The unusual properties of these compounds are due to the large orbital contributions to the magnetic moments of the rare-earths. As a result, the interactions between the rare-earth ions are described by higher-degree (multipolar) couplings. To better the understanding of the

cooperative phenomena in cubic rare-earth compounds, the cubic model on the f.c.c. lattice with antiferromagnetic interactions will be studied. To determine the origin of the flopside spin structure found in some of these compounds, the magnetic structures will be studied as a function of magnetic field. To determine the precise nature of the phase transitions in the n-component generalization of the cubic model, real space renormalization group methods will be used. The value of n for which the model is tricritical-like in zero fields will be sought. The changes in the critical behavior of the cubic model (n equals 3) will be studied as single-ion anisotropy and quadrupolar pair interactions are applied.

Research initiated under NSF Grant No. DMR72-02947.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0035, MAGNETIC INTERACTIONS IN SALTS OF THE TRANSITION METALS

S.A. FRIEDBERG, Carnegie Mellon University, Mellon Institute of Science, *Pittsburgh*, *Pennsylvania* 15213 (DMR75-13908 A02)

Studies of magnetic interactions in several classes of transition metal compounds will be continued. These compounds include salts with 1) singlet ground states exhibiting long-range spin order only in applied fields; 2) dominant antiferromagnetic coupling in one-dimensional array or isolated clusters; or 3) spins forming ordered two-and three-dimensional arrays. Measurements being made down to approximately 20 mK and in fields less than approximately 60 koe include those of heat capacity, magnetocaloric effect, magnetic susceptibilities and magnetic resonance. Among the problems under study are field-induced electronic ordering, in singlet ground state systems; the density of excited states in linear chain antiferromagnets; tricritical and bicritical points in antiferromagnets. Where possible, information about the arrangement and dynamics of these spin systems will be sought from neutron scattering experiments.

This is the 2nd year of a 3-year continuing grant (DMR-7513908).

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0036, HEAVY ION SIMULATION OF REACTOR DAMAGE

W.J. CHOYKE, Univ. of Pittsburgh, Graduate School, *Pittsburgh*, *Pennsylvania* 15213 (DMR75-01032 A02)

In this program bombardment with simultaneous high-energy ion beams is being used to simulate damage resulting from fast neutron irradiation of metals. The goals of the research are to: assess the validity of the simulation technique; determine the effects on displacement damage and target microstructure on helium distribution; and establish the conditions for the theoretically predicted transition from bias driven to gas driven swelling and possible saturation in swelling. High-energy ions are being used to avoid surface effects. The simultaneous beams permit simulation of both lattice damage and the creation of transmutation products.

This is a renewal of NSF Grant DMR7501032.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0037, THE EXCITATION OF METASTABLE ATOMS AND MOLECULES OF AERONOMIC INTEREST BY ELECTRON IMPACT

E.C. ZIPF, Univ. of Pittsburgh, School of Arts & Sciences, *Pittsburgh*, *Pennsylvania* 15260 (ATM75-21889)

This grant funds a series of experiments to study the excitation of atmospheric atoms and molecules by electron impact. In particular, it funds: 1. the measurement of electron-impact cross sections for 0(D1), L(S1), N(D2), N(P2), and N2(A 3 sigma J plus), 2. studies of the collisional deactivation of these metastable atoms and molecules as a function of their kinetic temperature over the range 2000-100,000 degrees K, 3. the quantitative determination of the reaction byproducts of these processes, and 4. studies of the excitation of the so-called auroral 'mystery' feature at 2150.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

8.0038, FAST OPTICAL SWITCHING IN NARROW-GAP SEMICONDUCTING MATERIALS

A.V. NURMIKKO, Brown University, Graduate School, *Providence*, *Rhode Island* 02912 (DF046910; AF-AFOSR-3199-77)

AF function - aerospace communications surveillance and detection systems require electrooptical devices which exploit the special properties and interactions of infrared radiation with solid-state materials. Opportunity - the far infrared region of the electromagnetic spectrum has been virtually unexplored for airborne and satellite applications. Sophisticated electrooptical techniques in narrow band gap compound semiconductors offer promise for optical microcircuitry in the 10 to 100 micrometer wavelength range. Objective - this research investigates the optical interactions between infrared radiation and solid-state materials, for the purpose of utilizing the special properties of enhanced transmittances or reflectances induced by optically excited degenerate electron-hole plasmas in such alloys as (HgCd)Te and (PbSn)Te narrow-gap semiconductors. How work contributes such unique properties could provide suitable materials for fast optical switches, modulators and gates for picosecond infrared pulsed transients and for integrated microcircuitry in infrared planar waveguides, optical communications and signal processing.

Suitable optical quality over a wide range of alloy compositions are being sought in narrow band-gap semiconducting materials with controlled compositional homogeneity and doping. The recombination processes and diffusion dynamics which occur at high excess carrier densities are being studied to provide basic understanding of the dynamics of the electron-hole plasmas in these semiconductors. Of particular interest is the coupling of a degenerate carrier gas to phonons and plasma waves in the materials.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

8.0039, TOPICS IN THE PHYSICS OF FLUIDS - PHASE TRANSITIONS TO A STATE OF LOWER SYMMETRY

J.B. SWIFT, Univ. of Texas, School of Natural Sciences, *Austin*, *Texas* 78712 (DMR76-11426)

This research is concerned with the question: what is the nature of the phase transition of a system to a state in which spatial translational and rotational symmetry are broken? Two specific examples are studied: 1) the nematic-smectic-c transition of a liquid crystal in which the spatially varying density in the smectic-c state breaks the relevant symmetry, and 2) the Rayleigh-Benard hydrodynamic instability in which the existence of the connection velocity field would break the symmetry. Although the second example does not involve a thermodynamic phase transition, both problems are expected to yield to treatment by method due to Brasovsky. Two other problems also are being studied: 1) dynamics near the tricritical point of a He3-He4 mixture by means of a microscopic model, 2) the effect of compound formation and the associated fluctuations in concentration on the transport and thermodynamic properties of binary liquid alloys.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0040, PHASE TRANSITIONS, CLUSTERING TENDENCIES AND ELECTRONIC PROPERTIES OF NON-CRYSTALLINE MATERIALS

J.C. THOMPSON, Univ. of Texas, School of Natural Sciences, *Austin*, *Texas* 78712 (DMR76-84338)

This research concerns the electronic energy levels in fluid materials - solutions or alloys - wherein the change of composition, density or temperature can cause a change of the electronic wavefunction from extended, as in a metal, to localized, as in a semiconductor, electrolyte or other nonmetal. The change in the nature of the wave function is reflected in changes in conductivity, Hall coefficient, and optical properties. These are measured.

Any concomitant changes in chemical association or phase transitions are determined from measurements of chemical potential. Systems studied are based on alkali metals in combination with liquid NH3, liquid chalcogenides such as Te, or similar materials. In the long range, this work is directed toward understanding the metal-nonmetal transition.

Continuation of work supported by DMR75-07828 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0041, CHEMICAL VAPOR DEPOSITION EPITAXIAL GROWTH AT LOW TEMPERATURE

D.W. SHAW, Texas Instruments Incorporated, *Dallas, Texas* 75222 (DF040320; F44620-75-C-0036)

AF function - microwave electronic devices are essential elements of Air Force communications, reconnaissance, surveillance, and countermeasures systems. Deficiency or opportunity - present microwave solid-state device performance is limited by the inability to grow very thin layers with extremely abrupt doping levels. Objective - to determine the optimum growth temperature and growth rate to produce high-purity, uniformly doped, thin layers with sharp boundaries for utilization in solid-state microwave amplifiers and generators and to produce buffer layers for GaAs FET structures. How work contributes -this work leads to improved microwave devices.

Complex GaAs epitaxial structures will be grown at subnormal and conventional temperatures and then a comparison will be made of the physical and electrical properties as well as the abruptness of the doping level at interfaces. The feasibility of growth of buffer layers suitable for FET structure will be assessed and the electrical properties of these layers will be characterized by capacitance-voltage and Hall effects measurements.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

8.0042, QUANTUM MECHANICAL SCATTERING AND GAUSSIAN FIELDS

J.S. HOWLAND, Univ. of Virginia, School of Arts & Sciences, *Charlottesville, Virginia* 22903 (MCS74-07313 A03)

This work continues that done under MPS74-07313A01.

This is a program for research in quantum mechanics and probability theory, primarily in the areas of scattering theory and Gaussian processes and fields.

Howland and Thomas will continue, separately and in collaboration, their recent work on the N-body quantum scattering problem and the scattering theory of quantum lattice systems. Thomas will also continue his work on stability of the ground state of systems with a large number of particles.

Pitt will continue his study of additive and multiplicative functionals of stationary Gaussian fields, and will also consider the problem of constructing non-Gaussian Markov fields which are locally equivalent to a given Gaussian field. He will also study certain inequalities concerning convex sets and the normal distribution, which are related to the Ornstein-Uhlenbeck process.

SUPPORTED BY U.S. National Science Foundation, Div. of Mathematical & Computer Sciences

8.0043, NUCLEAR THEORY

K. MCVOY, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (PHY74-05920 A04)

Research initiated under NSF grant PHY74-05920 AO2 will be continued. Topics in nuclear reactions theory to be investigated include problems in elastic and inelastic heavy-ion reactions, channel coupling, pion-nucleus scattering, electron-nucleus scattering, fluctuation cross sections and nuclear rearrangement effect. Among the specific topics for study are: Freidman and McVoy: 1. Regge poles in nuclear reactions. 2. Semi-Classical approximation in medium energy. 3. Elastic electron scattering from alpha-particle clusters in nuclei. McVoy: 1. Total pi-nucleus cross section in the energy region of the (3,3) resonance. 5. Multi-step phenomena in heavy-ion medium-energy reactions. Friedman: 1. Barrier top resonances. 2. Pi-Nucleus reactions. 3. Fission mass-asymmetry parameter and transfer reactions.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, CHRONOLOGY OF LIGHT PLAINS AND MARIA, AND FLUX HISTORY

J.M. BOYCE, U.S. Dept. of the Interior, Geological Survey, *Flagstaff, Arizona* 86001 (9580-01575)

The objectives of the current fiscal year are to collect additional relative age and impact flux data; correlate the relative age data with remote sensing data; correlate impact flux data with Apollo and Luna absolute age data; synthesize these data into a history and evolution of the lunar plains.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

10.0002, COSMIC BACKGROUND EXPLORER SATELLITE MISSION DEFINITION STUDY

L.W. ALVAREZ, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (NAS 5-24105)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

10.0003, SPACELAB MISSION 1 EXP. 95 - FAR UV OBSERVATIONS USING THE FAUST INSTRUMENT ON THE FIRST SPACELAB MISSION

UNKNOWN, Univ. of California, Graduate School, *Berkeley, California* 94720 (NAS 8-32577)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

10.0004, SYNOPTIC LUNAR GEOLOGIC MAPPING

D.E. WILHELMS, U.S. Dept. of the Interior, Geological Survey, *Menlo Park, California* 94025 (9580-01330)

Complete two tasks intended to summarize current lunar geologic knowledge in cartographic form: (1) A new geologic map of the central near side of the Moon, 50 degrees N - 50 degrees S, 50 degrees W - 50 degrees E, mercator projection, scale 1:5,000,000. Supersedes 1971 map of larger area at different projection that was based mostly on pre-Apollo data. Completes a series of post-Apollo maps at the same scale that together will cover the entire Moon. (2) Two paleogeologic maps of the inferred geology at two times in the Moon's history, whole near side, orthographic projection, scale 1:15,000,000 or 1:25,000,000. Both tasks are incorporating data gathered by the Apollo missions, especially the rock analyses, and by other 'remote sensing' experiments.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

10.0005, DYNAMIC OBSERVATIONS OF SOLAR MAGNETIC AND VELOCITY FIELDS

J.M. WILCOX, Stanford University, Inst. for Plasma Research, *Palo Alto, California* 94305 (ATM74-19007 A02)

This grant continues the work on dynamic observations of the solar magnetic and velocity fields. This work will be carried out at the Stanford Solar Observatory under the direction of Dr. John M. Wilcox as part of a 3-year continuing grant. The funding for the second year is recommended on the basis of the good progress made so far.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0006, A MICROPROCESSOR CONTROL SYSTEM FOR THE 200-INCH HALE TELESCOPE
G. NEUGEBAUER, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (AST76-16896)

The 200-inch Palomar telescope is the largest telescope regularly available to U.S. astronomers. The staff of the Hale observatories who regularly use this instrument are among the most productive research astronomers in the world.

A new position readout and telescope control system will be built for the 200-inch telescope. The system will provide the ability for computer control of telescope motions and will allow the telescope to be set with an accuracy of one second of arc.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0007, SUPERNOVAE AND EXTRAGALACTIC RESEARCH
W.L. SARGENT, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (AST76-81089)

The programs to discover supernovae with the 18-inch Schmidt telescope at Palomar and to carry out various lines of extragalactic research on quasars and compact galaxies with the large reflectors at the Hale Observatories and elsewhere will be continued. The research is divided into main topics: a) Continuation of the Palomar Supernova Search, which has been responsible for two-thirds of the supernovae discovered in modern times; b) An exploratory program of three-color photographs with the 48-inch Schmidt telescope, designed to discover radio-quiet quasars with redshifts zem greater than or equal to 3.0; c) Continuing spectroscopic studies of quasar absorption lines, consisting of high-resolution coude work of relatively bright objects on the one hand and low-resolution surveys for statistical purposes on the other. The work will be done with the Image Photon Counting System developed by Dr. A. Boksenberg at University College, London, and with a new Reticon device devised by Dr. S. Shectman of the Hale Observatories.

This action provides additional funding and extends the duration of grant AST 750555 A01 for 12 months.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0008, GEOPHYSICAL FLUID DYNAMICS
J.W. MILES, Univ. of California, School of Engineering, *San Diego, California* 92038 (OCE74-23791 A02)

This project will continue research in geophysical fluid dynamics in the La Jolla Laboratories of the Institute of Geophysics and Planetary Physics. The principal topics will be: (2) theoretical studies of tides and planetary waves in the terrestrial and other (especially Jovian) planetary atmospheres, (b) theoretical studies of internal tides in the ocean, (c) theoretical studies of equatorial currents and waves, (d) theoretical, and possibly experimental, studies of harbor resonance, and (e) experimental studies of wake collapse in rotating fluids.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

10.0009, MAUNA KEA OBSERVATORY 2.25M TELESCOPE CONTROL SYSTEM
T.B. MCCORD, Univ. of Hawaii, Graduate School, *Honolulu, Hawaii* 96822 (AST76-81951)

The Mauna Kea Observatory of the University of Hawaii is recognized as one of the finest sites for astronomical observations in the world. During the coming year the 88-inch (2.25) telescope facility will be upgraded to make it the dependable and versatile facility that the excellent site justifies and which modern technology easily allows. The telescope was designed and built in the late 1960'S; and although the telescope has been in constant and productive use since installation, there have been continuing problems with the telescope's electrical and electronic systems. This is because of the low quality of the delivered system, the lack of funds and trained personnel, and the lack of engineering downtime required to do a complete rebuilding. Even so, considerable skill and effort have been applied to improve the system. Nearly ten years have passed since the original system was designed. Observing techniques and technology have advanced considerably in this period, making the original design obsolete. After six years of operation the telescope has been shown to be mechanically and optically sound. It is now time to rebuild the electrical and electronic system, the key systems preventing efficient use of the facility.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0010, RESEARCH IN PLANETARY ASTRONOMY
T.B. MCCORD, Univ. of Hawaii, Graduate School, *Honolulu, Hawaii* 96822 (NSG 7323)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

10.0011, GALACTIC AND EXTRAGALACTIC MOLECULAR ASTRONOMY
P.E. PALMER, Univ. of Chicago, Graduate School, *Chicago, Illinois* 60637 (AST73-05282 A03)

At the time of a star's formation, and in many cases during its final stages of evolution, it is surrounded by a shell of dust that is impenetrable to visible light. Radio waves, however, are unimpeded by the obscuring dust. The discovery of radio frequency spectral line radiation from inside dust-enshrouded objects makes it possible for the first time to directly measure the temperatures, densities, and chemical compositions of regions which only a few years ago were almost wholly in the province of theoreticians. Many important results have already been obtained but much more remains to be done before we can understand in detail how a tenuous gas cloud evolves to form a star. We do not know how that star returns some of its mass to the interstellar medium, perhaps to be incorporated into other gas clouds and eventually into another generation of stars. Several studies aimed at providing some of the hard facts necessary to refine and quantify the process of stellar evolution will be carried out. Specifically, research will include:

1) Continued study of the peculiar object IRO plus 10216, which is believe to be a carbon star in the process of ejecting mass; 2) study of carbon monoxide emission from other galaxies; 3) study of lines from excited states of the hydroxyl radical; 4) study of ammonia lines from the central region of the galaxy and from 'cores' of dense sources; 5) searches for new molecular constituents of the interstellar medium; 6) completion of a program of mapping certain galactic sources in several molecular lines; and 7) completion of a project of searching for radio transmissions from extraterrestrial civilizations.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0012, INVESTIGATION OF MICROSCOPIC AND MACROSCOPIC PLASMA PROPERTIES WITH APPLICATION TO SPACE PLASMAS
G.R. JOYCE, Univ. of Iowa, School of Liberal Arts, *Iowa City, Iowa* 52240 (ATM76-82739)

This grant considers the application of numerical methods and analytical approximations to study the microscopic and macroscopic properties of space plasma systems. Specific areas to be studied include the following: the development and characteristics of potential double layers using solutions of the Vlasov equation and numerical simulations; the formation of double layers in the magnetospheres of Earth and Jupiter and associated particle acceleration and radio emissions; the observable effects of 100 kilovolt electrons and ions accelerated by Jupiter's moon Io; the development of turbulent cascades in magnetohydrodynamic plasmas; and the structure of the Jovian magnetosphere including the cold plasma, the current sheet and the energetic particles.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0013, A MILLIMETER WAVE TELESCOPE
G.R. HUGUENIN, Univ. of Massachusetts, School of Arts & Sciences, *Amherst, Massachusetts* 01002 (AST73-04949 A06)

The Five-College Radio Observatory will continue progress toward bringing into full scientific operation the recently completed 45-foot millimeter wave telescope located near Amherst, Massachusetts.

Specific tasks to be undertaken include: Completion of the final adjustments to the surface panels; Determination of telescope parameters by observations of celestial water vapor sources at a wavelength of 13.5 mm; Observations of celestial carbon monoxide sources at a wavelength of 2.6 millimeters; Testing and use at the telescope of a new 13 millimeter traveling wave maser; Continued development of a maser amplifier for observations at 3 millimeters.

In addition, a substantial program of pulsar observations will be continued both at the observatory and at the National Radio Astronomy Observatory.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0014, STELLAR POPULATIONS IN DISTANT REGIONS OF OUR GALAXY
K.A. JANES, Boston University, School of Liberal Arts, *Boston, Massachusetts* 02215 (AST76-01584 A01)

According to the concept of stellar populations set forth by Baade in 1944, the stars in our galaxy are divided into two basic groups, or populations, which differ in age not precisely defined. The basic idea of stellar populations has led to an increased understanding of the origin and evolution of the galaxy. Most studies of stellar populations have been based on stars in the immediate vicinity of the sun. However, this can lead to a somewhat biased view of the nature of stellar populations. This research will study the stellar populations in other parts of the galaxy in order to determine if there are regional variations in the chemical compositions of typical stars. The program to be carried out will consist of photometric observations of giant stars in several directions in the galaxy. There will be a detailed study of the problem of stellar populations in the galactic center. Spectra of stars in a number of globular clusters will be made. This project is a renewal of work previously supported under NSF Grant AST 76-01584.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0015, GALACTIC AND EXTRAGALACTIC ASTRONOMY
B.F. BURKE, Mass. Inst. of Technology, Graduate School, *Cambridge, Massachusetts* 02139 (AST76-20376)

A broadly-based radio astronomical investigation of H-II regions, molecular masers, galactic structure, radio galaxies, and quasars will be carried out. Very-Long-Baseline interferometry (VLBI) techniques will be used to study phenomena in quasars, radio galaxies, and masers, where high angular resolution is needed. Directed coupled Michelson interferometry, using the instruments of the National Radio Astronomy Observatory and a new aperture synthesis interferometer at MIT, will allow study of H-II regions and radio galaxies with resolution of the order of arcseconds. Both classes of interferometry will be carried to shorter wavelengths in the millimeter-wave region. Spectroscopic and continuum measurements, using large single radio telescopes, will be made when such observations are indicated. The ultimate aims of the program are to work toward an understanding of high-energy processes in galaxies, and to derive an accurate picture of the complete process of star formation.

This is a continuation of work previously supported by NSF grant AST73 05043A03.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0016, PRELIMINARY DESIGN AND DEVELOPMENT OF AN INFRARED REFLECTANCE SPECTROMETER
UNKNOWN, Mass. Inst. of Technology, Graduate School, *Cambridge, Massachusetts* 02139 (NASW 3008)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

10.0017, COSMIC BACKGROUND EXPLORER SATELLITE MISSION DEFINITION STUDY
R. WEISS, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (NAS 5-24096)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

10.0018, QUASARS AT RADIO WAVELENGTHS
J.F. WARDLE, Brandeis University, School of Arts & Sciences, *Waltham, Massachusetts* 02154 (AST74-18631 A02)

Flux density and linear polarization of some 90 variable radio sources at wavelengths of 11.1 and 3.7 cms will be monitored. Detailed analysis of the data collected together with development of new theoretical models to describe the phenomena discovered will be undertaken. These studies are of importance in the attempt to understand the exotic and bizarre processes taking place in the nuclei of galaxies and quasars where enormous amounts of energy are released on very short timescales. Present observations suggest that as well as aiding in understanding the radio outburts themselves, these data may serve as a very useful and sensitive probe of the whole nuclear environment.

A second facet of this research is the determination of the radio structure, spectra and polarization of a large complete sample of quasars whose optical properties are known. These data will be used for a statistical investigation of the joint optical radio properties of quasars.

This action provides additional funding and extends the duration of the grant number AST 74 18631A01 for 12 months.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0019, RADIATIVE TRANSFER IN NON-MONOTONIC FLOWS
P. NOERDLINGER, Michigan State University, School of Natural Sciences, *East Lansing, Michigan* 48824 (AST76-05766)

Most of the elements or minerals comprising the Earth, and living things on it, were formed in stars. Scientists are unsure of how these materials were cast out of dying stars into the galactic gas that nurtured the formation of the Sun and Earth. In the spectra of stars, certain gas clouds surrounding old stars, and exploding stars there is information indicating how much materials is leaving, and it is also possible to determine the chemical composition of the material. However, the understanding of such spectra is quite incomplete. In some cases, different theories produce estimates of the mass outflow that differ by factors of up to 100. This research will improve our understanding of this type of problem. Emphasis will be placed on the case where the material does not continually accelerate away from the star. Rather, the matter is slowed by gravity or by running into overlying material. An important benefit will be to further our understanding quasars. Many of them are believed to eject material at tremendous velocities. Can radiation pressure explain the ejection itself, or some unusual coincidences in which many objects seem to eject material at high speeds? If consistent answers to these problems cannot be obtained under the conventional idea that quasars are very far away, evidence will have been discovered of the operation of totally new physical laws - which will have to be formulated and evaluated.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0020, PLANETARY OBSERVATIONS USING A NEW FABRY-PEROT INTERFEROMETRIC METHOD
W.H. WMITH, Washington University, Graduate School, *St. Louis, Missouri* 63130 (NSG 7334)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

10.0021, BOLOMETER SYSTEM
J.R. HOUCK, Cornell University, School of Arts & Sciences, *Ithaca, New York* 14853 (NSG 7324)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

10.0022, CLIMATIC CHANGE ON THE PLANET EARTH - VOLCANIC EFFECTS AND HUMAN INTERVENTION
C.E. SAGAN, Cornell University, School of Arts & Sciences, *Ithaca, New York* 14853 (ATM76-81380)

The purpose of this investigation is to study the effects of volcanic, aerosol and anthropogenic activities on climate. Specifically the Principal Investigators will (a) complete a statistical study of the frequency of multiple volcanic explosions close enough together in time to be significantly applied to volcanic-climate-temperature models; (b) assess the size and composition of stratospheric aerosols located in polar regions to improve existing stratospheric-aerosol models; (c) perform global average calculations of the effects of tropospheric aerosols on climate; (d) estimate the climatic effects of anthropogenic changes on the earth's albedo occurring from overgrazing and local climatic changes and (e) compare the planet climatologies of the earth and Mars to evaluate radiation causes of climate change.

This research is a continuation of ATM74-29458 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0023, STUDIES OF DEGENERATE STARS
H.M. VANHORN, Univ. of Rochester, School of Arts & Sciences, *Rochester, New York* 14627 (AST76-80203)

A research program will be carried out on the properties of accreting white dwarf and neutron stars. There will be an investigation into the systematics of thermonuclear reactions on accreting white dwarfs and neutron stars. The goal of the white dwarf calculations will be to determine whether thermonuclear reactions on the surfaces of these stars can explain certain classes of novae. The computations on neutron stars will be directed towards constructing a model for the transient and X-ray sources being observed at the present time. There will be an investigation of the radial and non-radial oscillations of the white dwarf stars. This will be done in order to improve the description of the manner in which such stars can vary on short timescales, and to determine mechanisms which can give rise to the light variability observed in these stars. The surface layers of the white dwarf stars will be studied in order to examine the evolutionary connection between white dwarf stars and planetary nebulae. A grid of model atmospheres will be computed spanning the entire range of temperatures, surface gravities, and composition occupied by these stars. This work is a renewal of work previously supported by NSF Grant AST 74-13257A02.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0024, INVESTIGATIONS OF COSMIC-RAY INTENSITY VARIATIONS IN ANTARCTICA
M.A. POMERANTZ, Franklin Inst. of State of Pa., *Swarthmore, Pennsylvania* 19081 (DPP76-23429)

Solar and galactic cosmic-ray intensity variations will continue to be monitored at South Pole Station and McMurdo in Antarctica. A new cosmic-ray detector, the most sensitive in the world, will be installed at the South Pole Station for observations in an hitherto inaccessible range. Theoretical analysis of the observations made will continue with the objective of understanding the exotic processes on the sun and its atmosphere extending far beyond the orbit of the earth.

One person will winter over at South Pole Station and one will winter over at McMurdo in 1978, 1979 and 1980.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

10.0025, GEOLOGICAL THERMOMETRY - NASA
J.S. HUEBNER, U.S. Dept. of the Interior, Geological Survey, *Herndon, Virginia* 22092 (9710-01155)

Determine the physical properties and phase relations of pyroxenes, using a combination of optical and electron microprobe analyses, X-ray and electron diffraction, and experimental petrology. Apply the results to problems in lunar metamorphic equilibration; the dating of events which caused mineral transformations.

The major topics of investigation will be: 1) Interpret the thermal and structural histories of pyroxenes, estimating the lengths of time that each structural state was annealed at temperatures that we will determine from our data on pyroxene phase relations. We are interested in all processes from the nucleation of pyroxene in basalts at high temperature to the low temperature annealing that imposes the texturally mature fabric, the extensive chemical re-equilibration, and the high degree of cation order in 'Apollonian' metamorphic rocks. 2) Determine, experimentally and from analysis of lunar samples, the volume diffusion rates of calcium, magnesium and iron in pyroxenes in order to calculate the lengths of time necessary to grow pyroxene lamellae during lunar annealing processes. 3) Complete an experimental investigation of the partial melting of pyroxenes (orthopyroxene, pigeonite, augite) and model lunar mantle peridotite and pyroxenite. Continue to refine our models for the derivation of lunar basaltic magmas, and characterize the solid residues of such processes. 4) Complete a study of the occurrence, crystal chemistry, and significance of protoenstatite.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

10.0026, X-RAY SPECTROSCOPY
H.J. ROSE, U.S. Dept. of the Interior, Geological Survey, *Herndon, Virginia* 22092 (9770-00452)

X-ray spectroscopy, electron microprobe, and transmission and scanning electron microscopy are main areas of instrumentation. Major objectives are the development of methods and techniques for the bulk and micro-analysis of geologic specimens. An automated fully focusing X-ray spectrometer has been constructed and will be tested for trace element analysis as well as extending analytical capability to include fluorine.

Studies currently in progress include chemical and mineralogical characterization of gas condensates from burning coal culm banks, polished coal mounts, peat and coal ashes, unconsolidated sediments from the Atlantic Coastal plain, and the active support of other Survey investigations requiring micromineralogical and chemical analysis. Participation in the Viking Mars program will continue with the acquisition of additional samples (four have already been acquired and analyzed) after conjunction.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

10.0027, A HISTORY OF RADIO ASTRONOMY
W.T. SULLIVAN, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (SOC76-11299)

Dr. Sullivan is examining the worldwide growth and development of radio and radar astronomy from the first unsuccessful attempts in the 1890's until the explosive growth of the mid-1960's. A major source of information for his project is over 100 taped interviews with virtually all of the men who actually shaped the history. He is also conducting thorough searches through radio observatory archives and libraries all over the world. He is paying special attention to the manner in which radio astronomy grew as a discipline out of radio and radar engineering as well as ionospheric physics, and how it eventually became an accepted part of astronomy itself. His study emphasizes (a) the important interaction between science and technology as the field developed, and (b) the characters and motivations of the men and groups who founded the field and/or subsequently contributed to its later growth into maturity.

SUPPORTED BY U.S. National Science Foundation, Div. of Social Sciences

GENERAL

11.0001, OPERATION OF NASA INDUSTRIAL APPLICATIONS CENTER

J. MUNUSHAN, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (NASW 3031)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N77-28060*# Actuarial Research Corp., Falls Church, Va. Operational Systems Div.
AGRICULTURAL AVIATION USER REQUIREMENT PRIORITIES
Robert L. Kaplan, Tor Meeland, and Joan E. Peterson May 1977 77 p refs
(Contract NAS1-14758)
(NASA-CR-145215; FR-51-77) Avail: NTIS HC A05/MF A01 CSCL 02A

The results are given of a research project pertaining to the development of agricultural aviation user requirement priorities. The raw data utilized in the project was obtained from the National Agricultural Aviation Association. A specially configured poll, developed by the Actuarial Research Corporation was used to solicit responses from NAAA members and others. The primary product of the poll is the specification of seriousness as determined by the respondents for some selected agricultural aviation problem areas identified and defined during the course of an intensive analysis by the Actuarial Research Corporation. Author

N77-28061*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISON OF VGH DATA FROM WIDE-BODY AND NARROW-BODY LONG-HAUL TURBINE-POWERED TRANSPORTS
John A. Zalovcik, Joseph W. Jewel, Jr., and Garland J. Morris Washington Jul. 1977 41 p refs
(NASA-TN-D-8481; L-11381) Avail: NTIS HC A03/MF A01 CSCL 02A

Data are presented on incremental normal accelerations due to gusts, operational maneuvers, and check flight maneuvers, derived gust velocities, and the airspeed and altitude operating practices of one type of wide body, long haul transport airplane flown by five airlines on international routes. These data are compared with VGH data obtained from long haul, narrow body transport airplanes also flown over international routes. Author

N77-28062*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DEVELOPMENT OF A TRANSFER FUNCTION METHOD FOR DYNAMIC STABILITY MEASUREMENT
Wayne Johnson Washington Jul. 1977 46 p refs Prepared in cooperation with US Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TN-D-8522; A-6800) Avail: NTIS HC A03/MF A01 CSCL 02A

Flutter testing method based on transfer function measurements is developed. The error statistics of several dynamic stability measurement methods are reviewed. It is shown that the transfer function measurement controls the error level by averaging the data and correlating the input and output. The method also gives a direct estimate of the error in the response measurement. An algorithm is developed for obtaining the natural frequency and damping ratio of low damped modes of the system, using integrals of the transfer function in the vicinity of a resonant peak. Guidelines are given for selecting the parameters in the transfer function measurement. Finally, the dynamic stability measurement technique is applied to data from a wind tunnel test of a proprotor and wing model. Author

N77-28063*# Rail Co., Baltimore, Md.
MAINTENANCE COST STUDY OF ROTARY WING AIRCRAFT
Jun. 1977 159 p
(Contract NAS2-9143)
(NASA-CR-152003) Avail: NTIS HC A08/MF A01 CSCL 05C

The feasibility was studied of predicting rotary wing operation maintenance costs by using several aircraft design factors for the aircraft dynamic systems. The dynamic systems considered were engines, drives and transmissions, rotors, and flight controls. Multiple regression analysis was used to correlate aircraft design and operational factors with manhours per flight hour, and equations for each dynamic system were developed. Results of labor predictions using the equations compare favorably with actual values. F.O.S.

N77-28064# Naval Aviation Integrated Logistic Support Center, Patuxent River, Md.
PROCEDURE FOR THE DEVELOPMENT OF NAVAL AVIATION MAINTENANCE OBJECTIVES
William F. Lavallee, Philip Seidenberg, Walter J. Light, Brian P. Sneade, and James E. Ervin 18 Feb. 1977 34 p refs
(AD-A038201; NAILC-03-47X) Avail: NTIS HC A03/MF A01 CSCL 15/5

This document describes a methodology for developing Naval Aviation Maintenance Objectives. These objectives, when accomplished, are intended to provide for an effective aviation maintenance establishment in support of naval aviation and the Chief of Naval Operations' objective of fleet readiness through the 1977-1985 time frame. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N77-28065 California Inst. of Tech., Pasadena.
EXPERIMENTAL INVESTIGATION ON AXISYMMETRIC TURBULENT WAKES WITH ZERO MOMENTUM DEFECT Ph.D. Thesis
Hiroshi Higuchi 1977 225 p
Avail: Univ. Microfilms Order No. 77-3131

An experimental investigation of a turbulent axisymmetric wake with zero momentum defect was carried out. The experiment was conducted in a low speed wind tunnel with a circular tube

mounted parallel to the stream. A controlled amount of air was injected into the stream at the end of the model to cancel the drag produced by the turbulent boundary layer on the model. The measurements on the mean flow and the fluctuation quantities were carried up to 90 diameters downstream. By adjusting the strength of the injection, the behavior of the pure wake, the coflowing jet and the matched injection were examined, and the selfsimilar properties both in the mean velocity and the turbulent intensity were found to exist in these cases. Rapid decays of the centerline velocity and the maximum turbulent intensity were observed in the matched injection case. The effect of the initial condition was studied by artificially thickening the boundary layer on the model, and it was observed that the wake relaxes into the final decay law sooner. Dissert. Abstr.

N77-28066 Tennessee Univ., Knoxville.
A NEW METHOD TO CALCULATE THE VORTEX STRENGTH AND LOCATION OF SLENDER WINGS WITH FLOW SEPARATION Ph.D. Thesis
Dieter Kurt Nowak 1976 207 p
Avail: Univ. Microfilms Order No. 77-3671

Vortex shedding from side and leading edges of slender wings at angles of attack is examined. A flow model was developed that allows the calculation of the strength and location of the edge vortices from parameters obtained by linear potential flow theory. The Polhamus leading edge suction analogy and the Betz vortex laws were used. The model was applied to the case of a slender delta wing. Special emphasis was placed upon experimental information concerning the vortex shedding. The evaluation included water tunnel experiments. The flow model is based on an analogy between the sharp edge in potential flow without separation and the edge vortex in a flow with edge separation and subsequent reattachment. Dissert. Abstr.

N77-28067*# Scientific Translation Service, Santa Barbara, Calif.
LIFT CALCULATION AND FLOW MECHANISMS WHEN THE MAXIMUM LIFT IS EXCEEDED
Peter Jordan Washington NASA Jun. 1977 52 p refs Transl. into ENGLISH from Luftfahrt-Forsch. (Munich), v. 16, no. 4 p 184-193
(Contract NASw-2791)
(NASA-TT-F-17429) Avail: NTIS HC A04/MF A01 CSCL 01A

Flow observations and recordings of unsteady flow processes over straight and twisted wings were performed for one profile and a Reynolds number of 200,000. The foundations are laid for calculating the lift distributions, which must be supplemented with systematic measurements. Author

N77-28068*# Illinois Univ., Urbana. Dept. of Aeronautical and Astronautical Engineering.
PROGRAM MANUAL FOR THE EPPLER AIRFOIL INVERSION PROGRAM
William G. Thomson May 1975 54 p
(Grant NGR-14-005-144)
(NASA-CR-153928; UILU-ENG-75-0504; AAE-75-4) Avail: NTIS HC A04/MF A01 CSCL 01A

A computer program is described for calculating the profile of an airfoil as well as the boundary layer momentum thickness and energy form parameter. The theory underlying the airfoil inversion technique developed by Eppler is discussed. A.R.H.

N77-28069*# Illinois Univ., Urbana-Champaign. Aeronautical and Astronautical Engineering Dept.
LOW-SPEED AERODYNAMIC CHARACTERISTICS OF A 13.1-PERCENT-THICK, HIGH-LIFT AIRFOIL
Kenneth R. Sivier, Allen I. Ormsbee, and Randal W. Awker Apr. 1974 38 p refs Presented at Business Aircraft Meeting, Wichita, Kans., 2-5 Apr. 1974; sponsored by Soc. Automotive Eng.
(Grant NGR-14-005-144)
(NASA-CR-153937; SAE-740366) Avail: NTIS HC A03/MF A01 CSCL 01A

Low speed sectional characteristics of a high lift airfoil are studied and a comparison is made of those characteristics with the predictions of the theoretical methods used in the airfoil's design. The 13.1 percent-thick, UI-1720 airfoil was found to achieve the predicted maximum lift coefficient of nearly 2.0. No upper-surface, flow separation was found below the stall angle of attack of 16 degrees; it appeared that stall was due to an abrupt leading edge flow separation. Author

N77-28070*# Mississippi State Univ., Mississippi State. Dept. of Aerophysics and Aerospace Engineering.
A HIGH REYNOLDS NUMBER NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS IN STREAM FUNCTION-VORTICITY FORM M.S. Thesis
John H. Bearden Aug. 1977 50 p refs
(Grant NGR-25-001-055)
(NASA-CR-153933) Avail: NTIS HC A03/MF A01 CSCL 01A

Problems encoutered in investigations of high Reynolds number, incompressible flow are reviewed. A numerical solution computer program was modified to solve the stream function-vorticity form of the Navier-Stokes equations. Using a body fitted coordinate system with a U-shaped outer boundary, a simulation of incompressible flow at a Reynolds number of one million and a body angle of attack of zero was achieved. Author

N77-28071*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AERODYNAMIC CHARACTERISTICS OF A CANARD-CONTROLLED MISSILE AT MACH NUMBERS OF 0.8, 1.3, AND 1.75
Donald L. Kassner and Brian Wettlaufer (ARO, Inc.) Jul. 1977 256 p refs
(NASA-TM-X-73218; A-6956) Avail: NTIS HC A12/MF A01 CSCL 01A

A typical missile model with nose-mounted canards and cruciform tail surfaces was tested in the Ames 6- by 6-Foot Wind Tunnel to determine the contributions of the component aerodynamic surfaces to the static aerodynamic characteristics at Mach numbers of 0.8, 1.3, and 1.75 and Reynolds number of 625,000 based on body diameter. Data were obtained at angles of attack ranging from 0 deg to 24 deg for various stages of model build-up (i.e., with and without canard and/or tail surfaces). In addition, two different sets of canards and tail surfaces were investigated. For the canard and tail arrangements investigated, the model was trimmable at angles of attack up to about 7 deg with canard deflections of about 10 deg. Also, the tail arrangements studied provided ample pitch stability. Author

N77-28072*# Illinois Univ., Urbana-Champaign.
VISCID-INVISCID INTERACTION ASSOCIATED WITH INCOMPRESSIBLE FLOW PAST WEDGES AT HIGH REYNOLDS NUMBER Final Report
N. R. Warpinski and W. L. Chow Aug. 1977 142 p refs
(Grant NGL-14-005-140)
(NASA-CR-135246; ME-TR-395-4) Avail: NTIS HC A07/MF A01 CSCL 01A

An analytical method is suggested for the study of the viscid inviscid interaction associated with incompressible flow past wedges with arbitrary angles. It is shown that the determination of the nearly constant pressure (base pressure) prevailing within the near wake is really the heart of the problem, and the pressure can only be established from these interactive considerations. The basic free streamline flow field is established through two discrete parameters which adequately describe the inviscid flow around the body and the wake. The viscous flow processes such as the boundary layer buildup, turbulent jet mixing, and recompression are individually analyzed and attached to the inviscid flow in the sense of the boundary layer concept. The interaction between the viscous and inviscid streams is properly displayed by the fact that the aforementioned discrete parameters needed for the inviscid flow are determined by the viscous flow condition at the point of reattachment. It is found that the reattachment point behaves as a saddle point singularity for the system of equations describing the recompressive viscous flow processes, and this behavior is exploited for the establishment of the overall flow field. Detailed results such as the base pressure, pressure distributions on the wedge, and the geometry of the wake are determined as functions of the wedge angle. Author

N77-28073*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

REYNOLDS NUMBER EFFECTS ON THE AERODYNAMIC CHARACTERISTICS OF IRREGULAR PLANFORM WINGS AT MACH NUMBER 0.3

Robert L. Kruse, George H. Lovette, and Bernard Spencer, Jr. (NASA Langley Res. Center) Jul. 1977 422 p refs
(NASA-TM-X-73132; A-6599) Avail: NTIS HC A18/MF A01 CSCL 01A

The subsonic aerodynamic characteristics of a series of irregular planform wings were studied in wind tunnel tests conducted at M = 0.3 over a range of Reynolds numbers from 1.6 million to 26 million/m. The five basic wing planforms varied from a trapezoidal to a delta shape. Leading edge extensions, added to the basic shape, varied in approximately 5 deg increments from the wing leading edge sweep-back angle to a maximum 80 deg. Most of the tests were conducted using an NACA 0008 airfoil section with grit boundary layer trips. Tests were also conducted using an NACA 0012 airfoil section and an 8% thick wedge. In addition, the effect of free transition (no grit) was investigated. A body was used on all models. Author

N77-28074*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE AT MACH 3.52 OF A MACH 2.5 ALL EXTERNAL-COMPRESSION, TWO DIMENSIONAL INLET

Robert W. Cubbison Jun. 1977 43 p
(NASA-TM-73696; E-9235) Avail: NTIS HC A03/MF A01 CSCL 01A

A quick-look test was conducted in the 10- by 10-foot supersonic wind tunnel to provide some qualitative information on operating a low Mach number design inlet in a highly oversped condition. The model which is a two-dimensional, three-ramp, all-external-compression inlet designed to match a J-85 turbojet engine at Mach 2.5 was run at Mach 3.52 and zero angle-of-attack and yaw. Results are presented showing the effect of external ramp angle combinations, diffuser ramp position, and amount of bleed. Author

N77-28075# Aeronautical Research Council, London (England).

THE CHARACTERISTICS OF A FAMILY OF ROOFTOP AEROFOILS DESIGNED AT THEIR DRAG-RISE CONDITION IN VISCOUS, COMPRESSIBLE FLOW. PART 2: OFF DESIGN CONDITIONS

B. G. J. Thompson and S. W. Cosby (Short Brothers and Harland Ltd., Belfast) 1975 29 p refs Supersedes RAE-TR-72142 and ARC-34467
(ARC-CP-1321; RAE-TR-72142; ARC-34467;
ISBN-011-470931-9) Avail: NTIS HC A03/MF A01; HMSO £1.50; PHI

The problems of computing and of presenting off-design variations of profile drag for the new family of rooftop aerofoils described are examined by considering as a typical example a 50% rooftop section designed at a Mach number of 0.7 and having a thickness-chord ratio of 0.1. Profile drag results are presented as a set of polar curves of c sub d vs c sub l for a range of Mach numbers, and as contours of c sub d in the c sub l -m plane. Boundaries for rear separation, drag rise, and peak local Mach number equal to 1.2, are shown. For sections of given thickness-chord ratio and Mach number, the present results indicate that the minimum drag anywhere along the flight locus m squared c sub l = constant is obtained by choosing the particular section which has its design point on this locus. Author

N77-28076# Aeronautical Research Council, London (England).

DEVELOPMENTS IN THE LIFTING SURFACE THEORY TREATMENT OF SYMMETRIC PLANFORMS WITH A LEADING EDGE CRANK IN SUBSONIC FLOW

B. L. Hewitt and W. Kellaway 1975 51 p refs Supersedes ARC-33412
(ARC-CP-1323; ARC-33412; ISBN-0-11-4709335) Avail: NTIS HC A04/MF A01; HMSO £2.00; PHI

An attempt was made to develop a subsonic lifting surface theory method capable of calculating convergent loading solutions for symmetric planforms with a leading edge crank. A trace was made of the time history of thought and method development at B.A.C. which connects the successful treatments of regular and cropped delta type planforms. Finally, some mention is made of possible future generalisations of the basic cranked planform method. Author.

N77-28077# Aeronautical Research Council, London (England).

LOW-SPEED WIND-TUNNEL TEST OF A TWO-DIMENSIONAL WING FITTED WITH TWO PLAIN DIFFERENTIALLY-DEFLECTED TRAILING-EDGE FLAPS

John Mckie (RAE, Farnborough, Engl.) 1975 39 p refs Supersedes RAE-TR-74174 and ARC-35971
(ARC-CP-1326; RAE-TR-94174; ARC-35971;
ISBN-011-470936-X) Avail: NTIS HC A03/MF A01; HMSO £1.80; PHI

Chordwise pressure distributions were measured at several spanwise stations on a two dimensional model wing fitted with a plain hinged, trailing edge flap, at a Reynolds number of 1.9 million based on chord. The flap was divided into two parts and was deflected to a maximum of 5 deg. When the flaps were deflected differentially, the transition from a pressure distribution characteristic of the flaps deflected configuration, to one characteristic of te flaps up situation, took place within a spanwise distance of about 10% of the chord. The length was independent of the angle of incidence. Integrations for sectional normal force indicated, however, that modifications to the local circulation caused by a discontinuity in angle of flap deflection were apparent more than one chord distance away from the flap junction. Author

N77-28078# Aeronautical Research Council, London (England).

MEASUREMENTS OF PRESSURE DISTRIBUTION ON A HALF-MODEL WING-BODY COMBINATION OF 55 DEG. SWEEP OVER A WIDE RANGE OF REYNOLDS NUMBER

K. G. Winter (RAE, Bedford, Engl.) and J. B. Moss (RAE, Bedford, Engl.) 1975 157 p refs Supersedes RAE-TR-74149 and ARC-35978
(ARC-CP-1328; RAE-TR-74149; ARC-35978;
ISBN-011-470938-6) Avail: NTIS HC A08/MF A01; HMSO £4.90; PHI

The tests were made in a 8ft x 8ft wind tunnel mainly at a Mach number of 0.55 where a range of Reynolds number, based on wing chord, of 2 to 27 million was obtained for the pressure plotting station situated at about two thirds span. Limited tests were also made at a Mach number of 0.8, and at supersonic speeds. For angles of incidence for which the upper surface pressure distribution is of the design type, changes in Reynolds number do not produce changes in character of the flow. The lift developed depends upon the trailing edge boundary layer thickness and can be increased considerably by the action of vortex generators. At higher angles of incidence, the pressure recovery at the trailing edge is strongly influenced by the boundary layer condition. The results at supersonic speeds illustrate some features of shock wave boundary layer interaction. Author

N77-28079# Aeronautical Research Council, London (England).

INTERFERENCE PROBLEMS ON WING-FUSELAGE COMBINATIONS. PART 1: LIFTING UNSWEPT WING ATTACHED TO A CYLINDRICAL FUSELAGE AT ZERO INCIDENCE IN MIDWING POSITION

J. Weber (RAE, Farnborough, Engl.) 1975 45 p refs Supersedes RAE-TR-69130 and ARC-31532
(ARC-CP-1331; RAE-TR-69130; ARC-31532;
ISBN-011-470941-6) Avail: NTIS HC A03/MF A01; HMSO £1.60; PHI

The incompressible flow field past a single straight vortex line which crosses a cylindrical circular fuselage at right angles was studied. In particular the downwash induced in the plane through the vortex and the axis of the fuselage was determined numerically. The results are used to solve the design problem for an unswept wing of infinite aspect ratio for which the chordwise load distribution is given, and the spanwise distribution in the presence of the fuselage is required to be constant. It is shown how the interference effect varies with the ratio R/c between the body radius and the wing chord, and with the spanwise distance from the junction. A modification of existing methods for calculating the spanwise load distribution of wing-fuselage combinations is suggested to take account of the body interference with the chordwise load distribution. Author

N77-28080# Aeronautical Research Council, London (England).
INTERFERENCE PROBLEMS ON WING-FUSELAGE COMBINATIONS. PART 2: SYMMETRICAL UNSWEPT WING AT ZERO INCIDENCE ATTACHED TO A CYLINDRICAL FUSELAGE AT ZERO INCIDENCE IN MIDWING POSITION
J. Weber (RAE, Farnborough, Engl.) and M. G. Joyce (RAE, Farnborough, Engl.) 1975 71 p refs Supersedes RAE-TR-71179 and ARC-33437
(ARC-CP-1332; RAE-TR-71179; ARC-33437;
ISBN-011-470942-4) Avail: NTIS HC A04/MF A01; HMSO £2.30; PHI

The incompressible flow field past a single straight infinitely long source line which crosses a circular cylindrical fuselage at right angles was studied. In particular, the streamwise velocity component induced in the plane through the source line and the axis of the fuselage and the streamwise and circumferential velocity components induced on the surface of the fuselage were determined numerically. The results are used to determine the interference effect on the displacement flow past an unswept wing of infinite aspect ratio attached to a cylindrical fuselage. It is shown how the interference effect varies with the ratio R/c between the body radius and the wing chord. Author

N77-28081# Aeronautical Research Council, London (England).
INTERFERENCE PROBLEMS ON WING-FUSELAGE COMBINATIONS. PART 3: SYMMETRICAL SWEPT WING AT ZERO INCIDENCE ATTACHED TO A CYLINDRICAL FUSELAGE
J. Weber (RAE, Farnborough, Engl.) and M. Gaynor Joyce (RAE, Farnborough, Engl.) 1975 83 p refs Supersedes RAE-TR-73189 and ARC-35413
(ARC-CP-1333; RAE-TR-73189; ARC-35413;
ISBN-011-470943-2) Avail: NTIS HC A05/MF A01; HMSO £2.60; PHI

The interference effect on the incompressible displacement flow past a swept wing attached to a cylindrical fuselage in midwing position is studied. It is shown how this varies with the angle of sweep, with the section shape, and with the ratio R/c between the body radius and the wing chord. To reduce the amount of computation only wings of constant chord and constant section shape are considered. For these wings the results can easily be derived from the velocity field past a single kinked swept source line in the presence of a fuselage. The streamwise velocity component induced in the plane through the source line and the axis of the fuselage and the streamwise and circumferential velocity components induced on the surface of the fuselage were determined numerically, and the values are tabulated. It is shown by comparison with results from other methods that, by means of these tables, good estimates of the interference velocity can be derived also for tapered wings.
Author.

N77-28082# Aeronautical Research Council, London (England).
INTERFERENCE PROBLEMS ON WING-FUSELAGE COMBINATIONS. PART 4: THE DESIGN PROBLEM FOR A LIFTING SWEPT WING ATTACHED TO A CYLINDRICAL FUSELAGE
J. Weber (RAE, Farnborough, Engl.) and M. Gaynor Joyce (RAE, Farnborough, Engl.) 1975 59 p refs Supersedes RAE-TR-73190 and ARC-35294
(ARC-CP-1334; RAE-TR-73190; ARC-35294;
ISBN-011-470944-0) Avail: NTIS HC A04/MF A01; HMSO £2.20; PHI

The incompressible flow field past a circular cylindrical fuselage and a kinked infinite swept vortex, which lies in a plane through the axis of the fuselage, was studied. Values for the downwash in the plan and on the surface of the fuselage were determined numerically. The values are tabulated for four angles of sweep; 0, 30, 45, and 60 degrees. The results are used to design wings of constant chord and infinite aspect ratio, attached to a cylindrical fuselage in midwing position, for which the chordwise load distribution is given and the spanwise distribution in the presence of the fuselage is required to be constant. It is shown how the interference effect varies with the angle of sweep, with the ratio R/c between the body radius and the wing chord, with the spanwise distance from the wing body junction and with the thickness of the wing. Author

N77-28083# Weapons Research Establishment, Salisbury (Australia).
CALCULATION OF PRESSURE DISTRIBUTIONS ON TWO AXISYMMETRIC BOATTAILED CONFIGURATIONS
M. K. Haselgrove Feb. 1977 19 p refs
(WRE-TR-1779(W); AR-000-518) Avail: NTIS HC A02/MF A01

Computer programs are used to calculate the pressure distributions on two axisymmetric boattailed configurations in inviscid, incompressible flow. Realistic results are obtained in the base region by extending the body surface to simulate the surface streamline separating from the base. The results show that a favorable pressure gradient is created by replacing the rear portion of a boattail by a cylindrical section, and conversely an adverse gradient on a boattail is strengthened by the presence of a large sting on wind tunnel models. Author

N77-28084*# Auburn Univ., Ala. Dept. of Aerospace Engineering.
ANALYSIS AND COMPILATION OF MISSILE AERODYNAMIC DATA. VOLUME 1: DATA PRESENTATION AND ANALYSIS Final Report
James O. Nichols Washington NASA May 1977 126 p refs
(Grant NsG-1002)
(NASA-CR-2835) Avail: NTIS HC A07/MF A01 CSCL 16D

Most of the aerodynamic configurations considered are suitable for highly maneuverable air-to-air or surface-to-air missiles; however, data for a few air-to-surface, cruise missiles, and one projectile configuration are also presented. The Mach number range of the data is from about 0.2 to 4.63; however, data for most configurations cover only a portion of this range.
Author

N77-28085*# Auburn Univ., Ala. Dept. of Aerospace Engineering.
ANALYSIS AND COMPILATION OF MISSILE AERODYNAMIC DATA. VOLUME 2: PERFORMANCE ANALYSIS Final Report
John E. Burkhalter Washington NASA May 1977 316 p refs
(Grant NsG-1002)
(NASA-CR-2836) Avail: NTIS HC A14/MF A01 CSCL 16D

A general analysis is given of the flight dynamics of several surface-to-air and two air-to-air missile configurations. The analysis involves three phases: vertical climb, straight and level flight, and constant altitude turn. Wind tunnel aerodynamic data and full scale missile characteristics are used where available; unknown data are estimated. For the constant altitude turn phase, a three degree of freedom flight simulation is used. Important parameters considered in this analysis are the vehicle weight, Mach number, heading angle, thrust level, sideslip angle, g loading, and time to make the turn. The actual flight path during the turn is also determined. Results are presented in graphical form.
Author

N77-28086*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A COMPARISON OF THE EXPERIMENTAL AERODYNAMIC CHARACTERISTICS OF AN OBLIQUE WING WITH THOSE OF A SWEPT WING
Edward J. Hopkins and Sam C. Yee (ARO, Inc., Moffett Field, Calif.) Jun. 1977 483 p refs
(NASA-TM-X-3547; A-6894) Avail: NTIS HC A21/MF A01 CSCL 01A

Force and moment characteristics were measured for two trapezoidal oblique wings and a conventional swept wing mounted on a body of revolution at Mach numbers from 0.25 to 2.0. Both oblique wings had the same planform, but differed in profile and flexibility. One of the oblique wings was made of solid steel and had a maximum thickness-to-chord ratio of 4 percent. The other wing was built up by taking an aluminum wing and adding epoxy material to the upper surface to increase the maximum thickness-to-chord ratio to 8.2 percent. The aspect ratio for both oblique wings when swept 45 deg, and for the swept wing with 45 deg of sweep, was 4.1. Data were obtained at unit Reynolds numbers ranging from 3.3 to 8.2 million per meter and were compared with previously obtained data on the

aluminum wing before it was built up with epoxy. Wing flexibility designed into the aluminum and built-up aluminum oblique wings increased the range of lift coefficients from 0.30 to 0.70 over which the pitching-moment curves were linear. However, flexibility did not improve the linearity of the rolling-moment curves and produced sizable side forces. At a Mach number of 0.95, the trapezoidal oblique wing had little or no improvement in the lift/drag ratios over those for a conventional swept wing of the same aspect ratio, sweep, and profile. Author

N77-28087*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF JET MACH NUMBER DECAY DATA WITH A CORRELATION AND JET SPREADING CONTOURS FOR A LARGE VARIETY OF NOZZLES
Donald E. Groesbeck, Ronald G. Huff, and Uwe H. VonGlahn Washington Jun. 1977 300 p refs
(NASA-TN-D-8423; E-8561) Avail: NTIS HC A13/MF A01 CSCL 01A

Small-scale circular, noncircular, single- and multi-element nozzles with flow areas as large as 122 sq cm were tested with cold airflow at exit Mach numbers from 0.28 to 1.15. The effects of multi-element nozzle shape and element spacing on jet Mach number decay were studied in an effort to reduce the noise caused by jet impingement on externally blown flap (EBF) STOL aircraft. The jet Mach number decay data are well represented by empirical relations. Jet spreading and Mach number decay contours are presented for all configurations tested. Author

N77-28088*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AERODYNAMIC PERFORMANCE OF 0.4066-SCALE MODEL OF JT8D REFAN STAGE WITH S-DUCT INLET
Royce D. Moore, George Kovich, and George W. Lewis, Jr. Washington May 1977 296 p refs
(NASA-TN-D-8458; E-8268) Avail: NTIS HC A13/MF A01 CSCL 01A

A scale model of the JT8D refan stage was tested with a scale model of the S-duct inlet design for the refanned Boeing 727 center engine. Detailed survey data of pressures, temperatures, and flow angles were obtained over a range of flows at speeds from 70 to 97 percent of design speed. Two S-duct configurations were tested; one with a bellmouth inlet and the other with a flight lip inlet. The results indicated that the overall performance was essentially unaffected by the distortion generated by the S-duct inlet. The stall weight flow increased by less than 0.5 kg/sec (approximately 1.5% of design flow) with the S-duct inlet compared with that obtained with uniform flow. The detailed measurements indicated that the inlet guide vane (IGV) significantly reduced circumferential variations. For example, the flow angles ahead of the IGV were positive in the right half of the inlet and negative in the left half. Behind the IGV, the flow angles tended to be more uniform circumferentially. Author

N77-28089*# Mississippi State Univ., Mississippi State.
BOUNDARY-FITTED CURVILINEAR COORDINATE SYSTEMS FOR SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS ON FIELDS CONTAINING ANY NUMBER OF ARBITRARY TWO-DIMENSIONAL BODIES Final Report
Joe F. Thompson, Frank C. Thames, and C. Wayne Mastin Washington NASA Jul. 1977 254 p refs
(Grant NGR-25-001-055)
(NASA-CR-2729) Avail: NTIS HC A12/MF A01 CSCL 01A

A method is presented for automatic numerical generation of a general curvilinear coordinate system with coordinate lines coincident with all boundaries of a general multi-connected two-dimensional region containing any number of arbitrarily shaped bodies. No restrictions are placed on the shape of the boundaries, which may even be time-dependent, and the approach is not restricted in principle to two dimensions. With this procedure the numerical solution of a partial differential system may be done on a fixed rectangular field with a square mesh with no interpolation required regardless of the shape of the physical boundaries, regardless of the spacing of the curvilinear coordinate lines in the physical field, and regardless of the movement of the coordinate system in the physical plane. A number of examples of coordinate systems and application thereof to the solution of partial differential equations are given. The FORTRAN computer program and instructions for use are included. Author

N77-28090*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS OF A 1/6-SCALE POWERED MODEL OF THE ROTOR SYSTEMS RESEARCH AIRCRAFT
Raymond E. Mineck and Carl E. Freeman Washington Jun. 1977 240 p refs Prepared in cooperation with Army Air Mobility Res. and Develop. Lab., Moffett Field, Calif.
(DA Proj. 1F1-61101-AH-45)
(NASA-TM-X-3489; L-11287) Avail: NTIS HC A11/MF A01 CSCL 01A

A wind-tunnel investigation was conducted to determine the effects of the main-rotor wake on the aerodynamic characteristics of the rotor systems research aircraft (RSRA). For the investigation, a 1/6-scale model with a four-blade articulated main rotor was used. Tests were conducted with and without the main rotor. Both the helicopter and the compound helicopter were tested. The latter configuration included the auxiliary thrust engines and the variable-incidence wing. Data were obtained over ranges of angle of attack, angle of sideslip, and main-rotor collective pitch angle at several main-rotor advance ratios. Results are presented for the total loads on the airframe as well as the loads on the rotor, the wing, and the tail. The results indicated that without the effect of the rotor wake, the RSRA had static longitudinal and directional stability and positive effective dihedral. With the effect of the main rotor and its wake, the RSRA exhibited longitudinal instability but retained static directional stability and positive effective dihedral. Author

N77-28091*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND-TUNNEL INVESTIGATION OF A VARIABLE CAMBER AND TWIST WING
James C. Ferris Washington Aug. 1977 81 p refs
(NASA-TN-D-8475; L-11357) Avail: NTIS HC A05/MF A01 CSCL 01A

The longitudinal aerodynamic characteristics of a 35 deg swept, variable camber and twist semispan wing in the presence of a body were studied. The variable camber and twist were incorporated to allow a near optimum lift distribution over the wing for both the cruise condition and the high lift conditions for maneuverability. The wing incorporated movable leading-edge segments whose swept hinge lines provided maximum camber variations at the outboard leading edge and movable trailing-edge segments whose swept hinge lines provided maximum camber variations near the inboard trailing edge. The model was investigated at Mach numbers of 0.60, 0.80, and 0.90 through an angle-of-attack range from 0 deg to 10 deg or buffet onset. Author

N77-28092*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FREE-FLIGHT WIND-TUNNEL INVESTIGATION OF A FOUR-ENGINE SWEPTWING UPPER-SURFACE BLOWN TRANSPORT CONFIGURATION
Lysle P. Parlett Washington Aug. 1977 35 p refs
(NASA-TN-D-8479; L-11332) Avail: NTIS HC A03/MF A01 CSCL 01A

The dynamic stability and control characteristics of a four-engine turbofan transport model having an upper-surface blown jet flap were investigated by means of the free-flight technique in the Langley full-scale tunnel. The flight characteristics of the model were investigated through a range of lift coefficients from 3 to 8 with all four engines operating and with one outboard engine not operating. Static characteristics were investigated by conventional power-on force tests over the flight-test angle-of-attack range and through the stall. Author

N77-28093*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF EFFECT OF PROPULSION SYSTEM INSTALLATION AND OPERATION ON AERODYNAMICS OF AN AIRBREATHING HYPERSONIC AIRPLANE AT MACH 0.3 TO 1.2

James M. Cubbage and Charles E. Mercer Washington Jul. 1977 94 p refs
(NASA-TN-D-8503) Avail: NTIS HC A05/MF A01 CSCL 01A

Results from an investigation of the effects of the operation of a combined turbojet/scramjet propulsion system on the longitudinal aerodynamic characteristics of a 1/60-scale hypersonic airbreathing launch vehicle configuration are presented. Decomposition products of hydrogen peroxide were used for simulation of the propulsion system exhaust. Author

N77-28094*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS OF WING-BODY CONFIGURATION WITH TWO ADVANCED GENERAL AVIATION AIRFOIL SECTIONS AND SIMPLE FLAP SYSTEMS
Harry L. Morgan, Jr. and John W. Paulson, Jr. Washington Aug. 1977 71 p refs
(NASA-TN-D-8524; L-11305) Avail: NTIS HC A05/MF A01 CSCL 01A

Aerodynamic characteristics of a general aviation wing equipped with NACA 65 sub 2-415, NASA GA(W)-1, and NASA GA(PC)-1 airfoil sections were examined. The NASA GA(W)-1 wing was equipped with plain, split, and slotted partial- and full-span flaps and ailerons. The NASA GA(PC)-1 wing was equipped with plain, partial- and full-span flaps. Experimental chordwise static-pressure distribution and wake drag measurements were obtained for the NASA GA(PC)-1 wing at the 22.5-percent spanwise station. Comparisons were made between the three wing configurations to evaluate the wing performance, stall, and maximum lift capabilities. The results of this investigation indicated that the NASA GA(W)-1 wing had a higher maximum lift capability and almost equivalent drag values compared with both the NACA 65 sub 2-415 and NASA GA(PC)-1 wings. The NASA GA(W)-1 had a maximum lift coefficient of 1.32 with 0 deg flap deflection, and 1.78 with 41.6 deg deflection of the partial-span slotted flap. The effectiveness of the NASA GA(W)-1 plain and slotted ailerons with differential deflections were equivalent. The NASA GA(PC)-1 wing with full-span flaps deflected 0 deg for the design climb configuration showed improved lift and drag performance over the cruise flap setting of -10 deg. Author

N77-28095# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
NUMERICAL AND APPROXIMATE SOLUTION OF THE HIGH REYNOLDS NUMBER SMALL SEPARATION PROBLEM Final Report Oct. 1975 - 30 Sep. 1976
R. T. Davis 1 Sep. 1976 20 p refs Presented at the 13th Ann. Meeting of the Soc. of Eng. Sci., Hampton, Va., 1-3 Nov. 1976
(Contracts N00014-76-C-0364; N00014-76-C-0359)
(AD-A038661; AFL-76-8-24) Avail: NTIS HC A02/MF A01 CSCL 20/4

This study examines the high Reynolds number small separation problem and applies a simple integral method solution technique. A comparison is made with other more exact methods. Author (GRA)

N77-28096# Naval Surface Weapons Center, Dahlgren, Va.
AERODYNAMICS OF TACTICAL WEAPONS TO MACH NUMBER 3 AND ANGLE OF ATTACK 15 DEG. PART 1: THEORY AND APPLICATION Final Report
Frank G. Moore and Roy C. Swanson, Jr. Feb. 1977 86 p refs
(AD-A038918; NSWC/DL-TR-3584) Avail: NTIS HC A05/MF A01 CSCL 20/4

Several theoretical and empirical procedures are combined to form a useful design tool for computing static and dynamic aerodynamics on missiles, projectiles, and rockets. The Mach number and angle-of-attack range over which the method is applicable are OM = 0 to 3 and angle of attack equals 0 deg to 15 deg. respectively. Body and wing geometries can be quite general in that pointed or blunt nose bodies and sharp or blunt leading edge wings can be assumed. Computed results for several configurations compare well with experimental and other analytical results. The computer program is cost effective as it costs less than ten dollars per Mach number to compute the lift, drag, pitching moment, magnus moment, roll damping moment, and pitch damping moment of a typical wing-body shape on the CDC 6700 computer. Thus, a reasonably accurate dynamic stability analysis and performance estimates can be made for most tactical weapons up to Mach number 3 and angle of attack 15 deg without wind tunnel tests. Future efforts will be directed towards increasing the Mach number capability to 6, angle of attack to 180 deg, and incorporating air-breathing configurations into the analysis. Author (GRA)

N77-28097# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
EXPERIMENTAL OBSERVATIONS OF THE TWO-DIMENSIONAL POWER AUGMENTED RAM WING OPERATED STATICALLY OVER WATER Final Report, Jun. - Feb. 1977
B. H. Carson Mar. 1977 33 p refs
(AD-A038163; DTNSRDC/ASED-372) Avail: NTIS HC A03/MF A01 CSCL 20/4

Experiments were performed in a rectangular tank, partially filled with water and spanned by a flat-bottomed airfoil section, derived from an NACA 0015 thickness distribution. Upstream of the airfoil was placed a two-dimensional air jet, also spanning the tank. One side of the tank was transparent, to permit flow visualization. Two-dimensional turbulent jet theory was used to establish the relationship between the jet exit dynamic pressure and the pressure recovery under the wing, which was supported by experimental evidence. It was found that the recovery of pressure was not highly sensitive to jet geometry; however, the formation of spray was. For minimum spray formation, a jet impingement angle of about 25 deg was established. Several interesting wind-wave flow instabilities were observed. A thrust-reversal phenomenon, predicted by inviscid theory, could not be duplicated in the present experiment. Author (GRA)

N77-28098# Naval Ship Research and Development Center Bethesda, Md.
A COMPARISON BETWEEN A SIMPLE DRAG FORMULA AND EXPERIMENTAL DRAG DATA FOR BODIES OF REVOLUTION Final Report
Nadine M. White Jan. 1977 67 p refs
(AD-A038392; DTNSRDC-77-0028) Avail: NTIS HC A04/MF A01 CSCL 20/4

A simplified drag formula to predict the drag of a small number of axisymmetric forms is systematically applied to seven series of model forms comprising nearly fifty bodies. Calculations of form (or residual) drag are compared to available experimental data in order to determine the usefulness of the method for predictive purposes. The formula is shown to exhibit very little sensitivity to changes in most body parameters such as the length-of-stern to diameter ratio, nose and tail radii parameters, and the prismatic coefficient. For some parameters, such as length to diameter ratio, the length of bow section to diameter ratio, however, the formula is sometimes able to discriminate bodies having high values of form drag. It is concluded that the simple drag formula may not be reliably used for estimating the relative form drags of bodies of revolution. Author (GRA)

N77-28099# California Univ., La Jolla.
BALLOON COMMAND-CONTROL Final Report, 1 Aug. 1975 - 31 Jul. 1976
P. Roger Williamson 7 Jan. 1977 23 p
(Contract N00014-76-C-0258; NR Proj. 211-185; RR0330301)
(AD-A036248) Avail: NTIS, HC A02/MF A01 CSCL 17/2

Testing and modification of a low-cost expendable flight termination device for small balloon operators is presented. This is a tonal control transmitter/receiver system using phase-locked loop circuitry to insure safe interference free operation. Design circuitry is included in this report. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N77-28100*# Little (Arthur D.), Inc., Cambridge, Mass.
THE MARKET FOR AIRLINE AIRCRAFT: A STUDY OF PROCESS AND PERFORMANCE
Nov. 1976 204 p refs Prepared in cooperation with Simat, Helliesen and Eichner, Inc., Tarrytown, N. J.
(Contract NASw-2971)
(NASA-CR-154617) Avail: NTIS HC A10/MF A01 CSCL 01C

The key variables accounting for the nature, timing and magnitude of the equipment and re-equipment cycle are identified and discussed. Forecasts of aircraft purchases by U.S. trunk airlines over the next 10 years are included to examine the anatomy of equipment forecasts in a way that serves to illustrate how certain of these variables or determinants of aircraft demand can be considered in specific terms. Author

N77-28101*# Michigan Univ., Ann Arbor. Graduate School of Business Administration.
EVALUATION OF NASA-SPONSORED RESEARCH ON CAPITAL INVESTMENT DECISION MAKING IN THE CIVIL AVIATION INDUSTRY
David J. Donovan Mar. 1977 27 p refs
(NASA Order W-14258)
(NASA-CR-154620) Avail: NTIS HC A03/MF A01 CSCL 05C

Significant findings of three studies undertaken to provide the NASA Aircraft Energy Efficiency (ACEE) Office with information regarding how aircraft manufacturers and commercial airlines make investment decisions concerning the acquisition of new and derivative technology are analyzed and their general implications explored. Topics discussed include: the market for airline aircraft, factors affecting the corporate decision making process of air transport manufacturers, and flight equipment purchasing practices of representative air carriers. Author

N77-28102# Naval Weapons Center, China Lake, Calif.
AIRCRAFT FIRE SIMULATOR TESTING OF CANDIDATE FIRE BARRIER SYSTEMS Test and Evaluation Report, Feb. - Sep. 1976
Herman H. Hoffman and John S. Fontenot Nov. 1976 43 p
(AD-A038601; NWC-TP-5915) Avail: NTIS HC A03/MF A01 CSCL 01/2

The results of a study to evaluate candidate aircraft fire barrier materials to in-flight fires are presented. Four organic materials, two inorganic materials, and three metallics combined with insulators were tested in an in-flight fire simulator. Eight intumescent coatings were evaluated to determine their ability to close barrier gaps in the event of a fire. Author (GRA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N77-28103 Purdue Univ., Lafayette, Ind.
MANUAL CONTROL DISPLAYS FOR A FOUR DIMENSIONAL LANDING APPROACH Ph.D. Thesis
James Taylor Silverthorn 1976 136 p
Avail: Univ. Microfilms Order No. 77-1776

Six instrument rated pilots flew a STOL fixed base simulator to study the effectiveness of three displays for a four-dimensional approach. The three examined displays were a digital readout of forward position error, a digital speed command, and an analog display showing forward position error and error prediction. A flight director was used in all conditions. All test runs were for a typical four-dimensional approach in moderate turbulence that included a change in commanded ground speed, a change in flight path angle, and two standard rate sixty degree turns. Use of the digital forward position error display resulted in large overshoot in the forward position error. The best overall performance was obtained using the speed command display. It was demonstrated that curved approaches can be flown with relative ease. Dissert. Abstr.

N77-28104# Aeronautical Research Council, London (England).
DESIGN AND THEORETICAL ASSESSMENT OF EXPERIMENTAL GLIDE PATH AND FLARE SYSTEMS FOR A BAC 1-11 AIRCRAFT (INCLUDING DIRECT LIFT CONTROL)
F. R. Gill (RAE, Farnborough, Engl.) and M. J. Corbin (RAE, Farnborough, Engl.) 1975 66 p refs Supersedes RAE-TR-74013 and ARC-35979
(ARC-CP-1337; RAE-TR-74013; ARC-35979; ISBN-011-470947-5) Avail: NTIS HC A04/MF A01; HMSO £2.60; PHI

Two experimental glide path and flare systems are described, one using spoilers installed in the aircraft to provide direct lift control. The various longitudinal control modes, altitude hold, glide path and flare, have similar feedback control gains whose values were determined by parameter optimisation. An assessment of the performance of these two systems is described. Using elevator and throttle control only, there was little improvement over current flare systems, but use of high gain direct lift control gives significant improvement. Author

N77-28105# Missouri Univ., Rolla. Dept. of Electrical Engineering.
RANGE-LIMITED HORIZON CORRELATION FOR NAVIGATION CHECKPOINTING Technical Report, 1 Mar. 1976 - 28 Feb. 1977
Gordon E. Carlson, Charles M. Benoit, and Paul W. Sapp Mar. 1977 76 p
(Contract N00014-75-C-0639)
(AD-A038247; CSR-77-1) Avail: NTIS HC A05/MF A01 CSCL 17/7

A performance study for a system which uses range-limited horizons as navigation checkpoints for an airborne vehicle is presented. This is a continuation of performance studies previously reported for systems using actual horizons and fixed-range terrain profiles. The use of range-limited horizons permits a single system concept to be used at all vehicle altitudes. Digital topographic data and computer simulations used for system performance analyses are described. Analysis results are presented for flights at various altitudes. Different terrain roughnesses and a range of random profile errors and vehicle altitude errors are considered. System error limits are selected to give suitable checkpoint detection performance and position and heading determination errors are analyzed. The results indicate that system operation is feasible if sufficient terrain roughness is available at the checkpoint location. The results of an analysis of the effects of vehicle motion during sensor scan and sensor azimuth beamwidth are presented. Author (GRA)

N77-28106# Facility Checking Squadron (1868th) (AFCS), APO New York 09332.
TRACALS EVALUATION REPORT. NAVAIDS STATION EVALUATION REPORT, AVIANO AB, ITALY (16-23 AUGUST 1976) Final Report
Robert L. Jones 25 Feb. 1977 65 p
(AD-A038062; Rept-76/68-T-1d) Avail: NTIS HC A04/MF A01 CSCL 17/7

This Traffic Control and Landing Systems (TRACALS) station evaluation report presents data collected to define the capabilities and limitations of the Tactical Air Navigation (TACAN) System, AN/GRN-19A, with an AN/GRA-120 antenna system and associated power equipment at Aviano Air Base, Italy. Included in the report are coverage diagrams and analysis of airborne and ground performance data. Data analysis indicates the configuration to be capable of satisfying the required mission.

The data presented in this report can be used as a valid guide to this facility's anticipated performance until there is a configuration change which alters the capabilities of the equipment, or until a change occurs in the horizontal profile. Author (GRA)

N77-28107# Naval Postgraduate School, Monterey, Calif.
THE KALMAN FILTER APPLIED TO PROCESS RANGE DATA OF THE CUBIC MODEL 40 AUTOTAPE SYSTEM M.S. Thesis
Benjamin E. Julian Dec. 1976 67 p refs
(AD-A038777) Avail: NTIS HC A04/MF A01 CSCL 17/7

The Kalman Filter is implemented to process range data output from the Cubic Model 40 Autotape system, a surface position locating system currently employed on the underwater tracking ranges at Dabob Bay and Nanoose. Results are presented for different measurement noise and forcing function noise statistics. Author (GRA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N77-28108*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLUT - A PROGRAM FOR AEROELASTIC STABILITY ANALYSIS
Erwin H. Johnson Jun. 1977 57 p refs
(NASA-TM-73217; A-6955) Avail: NTIS HC A04/MF A01 CSCL 01C

A computer program (FLUT) that can be used to evaluate the aeroelastic stability of aircraft structures in subsonic flow is described. The algorithm synthesizes data from a structural vibration analysis with an unsteady aerodynamics analysis and then performs a complex eigenvalue analysis to assess the system stability. The theoretical basis of the program is discussed with special emphasis placed on some innovative techniques which improve the efficiency of the analysis. User information needed to efficiently and successfully utilize the program is provided. In addition to identifying the required input, the flow of the program execution and some possible sources of difficulty are included. The use of the program is demonstrated with a listing of the input and output for a simple example. Author

N77-28109*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED WIND-TUNNEL INVESTIGATION OF A LARGE-SCALE ADVANCED ARROW WING SUPERSONIC TRANSPORT CONFIGURATION WITH ENGINES MOUNTED ABOVE THE WING FOR UPPER-SURFACE BLOWING
James P. Shivers, H. Clyde McLemore, and Paul L. Coe, Jr. 2 Aug. 1977 67 p refs
(NASA-TM-X-72761) Avail: NTIS HC A04/MF A01 CSCL 01C

The Langley full scale tunnel was used to investigate the low speed stability and control of an advanced arrow wing supersonic transport with engines mounted above the wing for upper-surface blowing. Tests were made over an angle of attack range of -10 to 32 deg, slideslip angles of + or -5 deg and a Reynolds number ranging from 3.53 million to 7.33 million (referenced to mean aerodynamic chord of the wing). Configuration variables included trailing-edge flap deflection, engine jet nozzle angle, engine thrust coefficient, engine out operation, and asymmetrical trailing-edge BLC for providing roll trim. Downwash measurements at the tail were obtained for different thrust coefficients, tail heights, and at two fuselage stations. Author

N77-28110# Aeronautical Research Council, London (England).
AN ASSESSMENT OF THE ACCURACY OF SUBSONIC LINEARIZED THEORY FOR THE DESIGN OF WARPED SLENDER WINGS
Patricia J. Davies (RAE, Farnborough, Engl.) 1975 40 p refs Supersedes RAE-TR-73159 and ARC-35314
(ARC-CP-1324; Rae-TR-73159; ARC-35314; ISBN-011-470934-3) Avail: NTIS HC A03/MF A01; HMSO £1.80; PHI

A series of warped slender wings were designed using the linearized theory of subsonic flow, as a basis for a systematic experimental investigation of the drag reduction obtainable by warp at low speeds. The force measurements on these wings are supplemented by measurements of the pressure distribution over one of them; and the pressure distribution on it was calculated for inviscid incompressible flow by a surface singularity method. The distribution of pressure used in the design is compared with those measured and calculated for the design incidence, at which the flow was attached; and assesses the validity of the linear theory. The chief weaknesses are found to be on the thicker cross sections near the apex, and towards the trailing edge where boundary layer effects become significant. Author

N77-28111*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONSTANT LIFT ROTOR FOR A HEAVIER THAN AIR CRAFT Patent Application
Robert H. Stroub, inventor (to NASA) Filed 25 Jul. 1977 17 p
(NASA-Case-ARC-11045-1; US-Patent-Appl-SN-818916) Avail: NTIS HC A02/MF A01 CSCL 01C

A constant lift rotor is described. It consists of a rotor blade radially from a hub, with an elongated spar and several axially aligned shells pivotally mounted on the spar, each having an aerodynamic center located in trailing relation with the spar, and supported for simultaneous axial and angular displacement as centrifugal forces are applied. The pitch is controlled by limiting arms transverse to the spar, each characterized by a cam surface along one edge, supporting a cam follower of a truck, pivotally connected to a shell and supported for pivotal motion about an axis coincident with a radius of the spar. A push-pull link interconnects the arms for imparting pivotal motion, whereby the angular relationship of the arms to the spar is varied for changing the motion of the trucks along the arms for limiting the pitch of the segments about the spar. NASA

N77-28112*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOAD AND STABILITY MEASUREMENTS ON A SOFT-INPLANE ROTOR SYSTEM INCORPORATING ELASTOMERIC LEAD-LAG DAMPERS
William H. Weller Washington Jul. 1977 70 p refs Prepared in cooperation with the US Army Air Mobility R and D Lab., Hampton, Va.
(DA Proj. 1L2-62209-AH-76)
(NASA-TN-D-8437; L-11315) Avail: NTIS HC A04/MF A01 CSCL 01C

An experimental investigation was conducted of the dynamic response and inplane stability associated with a new soft-inplane helicopter rotor. The unique feature of this rotor was the use of an internal elastomeric damper to restrain the blade inplane motion about the lead-lag hinge. The properties of the elastomer were selected to provide both a nominal first inplane frequency ratio of 0.65 and sufficient damping to eliminate the need for additional external damping sources to prevent ground resonance on a typical fuselage structure. For this investigation a 1/5-scale aeroelastic model was used to represent the rotor. The four-blade model had a diameter of 3.05 m (10 ft) and a solidity of 0.103. The first out-of-plane frequency ratio was 1.06. The model was tested in hover and in forward flight up to an advance ratio of 0.45. At each forward speed the rotor lift was varied up to simulated maneuver conditions. The measured rotor loads and response were within acceptable limits, and no adverse response qualities were observed. Moderate out-of-plane hub moments were measured, even for zero lift, to indicate the beneficial control power available for this design. Blade inplane stability testing indicated that the rotor system damping remained at moderate levels throughout the operating envelope. Author

N77-28113*# Computer Sciences Corp., Mountain View, Calif.
COMPUTERS FOR REAL TIME FLIGHT SIMULATION: A MARKET SURVEY
George A. Bekey and Walter J. Karplus Washington NASA Jul. 1977 84 p

(Contract NAS2-7806)
(NASA-CR-2885) Avail: NTIS HC A05/MF A01 CSCL 01C

An extensive computer market survey was made to determine those available systems suitable for current and future flight simulation studies at Ames Research Center. The primary requirement is for the computation of relatively high frequency content (5 Hz) math models representing powered lift flight vehicles. The Rotor Systems Research Aircraft (RSRA) was used as a benchmark vehicle for computation comparison studies. The general nature of helicopter simulations and a description of the benchmark model are presented, and some of the sources of simulation difficulties are examined. A description of various applicable computer architectures is presented, along with detailed discussions of leading candidate systems and comparisons between them. Author

N77-28114# Army Materials and Mechanics Research Center, Watertown, Mass.
SECONDARY DAMAGE TO AIRCRAFT BY RICOCHETED SMALL ARMS PROJECTILES AND FRAGMENTS Final Report
Stuart V. Arnold and Russel G. Hardy Nov. 1976 26 p
(AD-A038755; AMMRC-TR-76-35) Avail: NTIS HC A03/MF A01 CSCL 19/1

Under certain conditions of oblique impact against aircraft structures, small arms projectiles (or fragments thereof) ricochet, thereby causing damage to adjoining structures, components, or personnel. This report describes terminal ballistics of caliber .30 AP M2 and 7.62-mm ball M59 projectiles striking 0.375-inch-thick 2024-T351 aluminum and 0.25-inch-thick Ti-6Al-4V alloy plates over ranges of obliquity and velocity. Effects of these factors upon potential for secondary damage are assessed. Principles for design of aircraft structures to reduce vulnerability to ricochet damage are proposed. Author (GRA)

N77-28115# Air Force Flight Test Center, Edwards AFB, Calif.
C-141A PITOT-STATIC SYSTEM CALIBRATION TESTS
Ronald K. Pomeroy, Herbert Klein, Joseph A. Guthrie, Jr., and Thomas P. Stafford Dec. 1976 25 p refs
(AD-A036241) Avail: NTIS HC A02/MF A01 CSCL 14/2

The flight test program consisted of six C-141A/T-38A pacer flights. On flight 2, a series of tower fly-by points were also accomplished. Prior to each flight a ground calibration of the aircraft's pitot-static systems was performed (Appendix B). Each of the six pacer flights consisted of 30,000 and 20,000 feet (MSL) cruise configuration, and 10,000 feet (MSL) takeoff and landing configuration points. On flight 5, adverse weather conditions prohibited flight operations at 10,000 feet. The T-38A pacer position and alignment, detailed in figure A1, enabled the pacer pilot to perceive small airspeed and altitude changes, while maintaining a position outside the C-141A pressure wave. GRA

N77-28116# Naval Postgraduate School, Monterey, Calif.
A PERSONALIZED SYSTEM OF INSTRUCTION FOR AIRCRAFT PERFORMANCE M.S. Thesis
Donald Leslie Finch Mar. 1977 412 p refs
(AD-A039654) Avail: NTIS HC A18/MF A01 CSCL 05/9

A personalized system of instruction utilizing self-contained text material and combining the principle of autotutorial instruction with modified self-pacing was developed for a course in aircraft performance. The course material was applied to the aircraft performance portion (six weeks) of a 12 week course in aircraft performance, control and stability taught to 11 students. The course results tended to confirm the advantages and substantial value of this instructional method. GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N77-28117# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
FEASIBILITY OF MULTISENSOR COMBINED DISPLAYS Final Report, May - Dec. 1976
John R. Bloomfield, Patrick D. Pratt, Robert J. Hughes, and Leon G. Williams Dec. 1976 138 p refs
(Contract N00014-76-C-0797)
(AD-A036285; ONR-CR-213-140-1) Avail: NTIS HC A07/MF A01 CSCL 09/5

In this study of multisensor displays, the objectives were to consider different display formats, and to suggest simple, efficient ways of implementing electronic and optical methods of combining images. The study is part of a more general U.S. Navy program to develop a system for combining the information from several sensors on a single display surface. Until recently, the complexity and number of cockpit instruments increased with the complexity of aircraft and the functions for which they could be used. Then, because of advances in display technology, multifunctional, integrated display systems were developed. Their immediate appeal is that they require relatively little cockpit panel space. Eight methods of presenting multiple images were identified. They included superimposition, juxtaposition in time, split screen, and various forms of insetting. The appropriateness of these eight methods for each of the four uses of multiple-image presentation was considered. Of the 32 combinations of uses and methods, 11 were judged to be promising, a further 11 were possible, while the remaining 10 were inappropriate. Various sensors and displays, as well as techniques for image combining, scan conversion and symbol writing were reviewed. They were evaluated in terms of their applicability to the multi-image presentation cases listed above. Of eight image-combining techniques evaluated, the one with the greatest potential for a low-cost, near-term, multi-function display was judged to be optical image combining. Digital computer techniques for more complex applications were also discussed. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N77-28118* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DUAL CYCLE AIRCRAFT TURBINE ENGINE Patent
Mark R. Nichols, inventor (to NASA) Issued 5 Jul. 1977 8 p Filed 6 Sep. 1973 Supersedes N73-31699 (11 - 22, p 2710)
(NASA-Case-LAR-11310-1; US-Patent-4,033,119; US-Patent-Appl-SN-394898; US-Patent-Class-60-226R; US-Patent-Class-60-263; US-Patent-Class-415-145) Avail: US Patent Office CSCL 21E

A method and apparatus are presented for improving operating efficiency over broad ranges of flight conditions and for reducing jet engine noise output in takeoff and landing by controlling the airflow entering and exiting the engines. A turbojet engine apparatus is described which operates efficiently at both subsonic and supersonic speeds and a method is described which enables a turbofan with an associated satellite turbojet or turbofan to operate more efficiently at both subsonic and supersonic speeds. In both cases, takeoff and landing noise is reduced substantially. The apparatus consists essentially of arranging for two separate portions of an engine to act upon one airstream or, alternately, to operate on independent airstreams.
Official Gazette of the U.S. Patent Office

N77-28119*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AERO-ACOUSTIC PERFORMANCE COMPARISON OF CORE ENGINE NOISE SUPPRESSORS ON NASA QUIET ENGINE C
Harvey E. Bloomer and John W. Schaefer Jul. 1977 20 p refs Presented at the 13th Propulsion Conf., Orlando, Fla., 11-13 Jul. 1977; Cosponsored by the Am. Inst. of Aeron. and

the Soc. of Automotive Engr.
(NASA-TM-X-73662; E-9182) Avail: NTIS HC A02/MF A01 CSCL 21H

The relative aero-acoustic effectiveness of two core engine suppressors, a contractor-designed suppressor delivered with the Quiet Engine, and a NASA-designed suppressor was evaluated. The NASA suppressor was tested with and without a splitter making a total of three configurations being reported in addition to the baseline hardwall case. The aerodynamic results are presented in terms of tailpipe pressure loss, corrected net thrust, and corrected specific fuel consumption as functions of engine power setting. The acoustic results are divided into duct and far-field acoustic data. The NASA-designed core suppressor did the better job of suppressing aft end noise, but the splitter associated with it caused a significant engine performance penality. The NASA core suppressor without the splter suppressed most of the core noise without any engine performance penalty.
Author

N77-28120# Aeronautical Research Council, London (England).
MEASUREMENTS OF SECONDARY LOSS IN A MODEL TURBINE WITH VARIABLE INLET BOUNDARY LAYER
J. D. Denton (Central Elec. Generating Board, London) and C.G. Johnson 1975 17 p refs Supersedes ARC-35921
(ARC-CP-1335; ARC-35921; ISBN-011-470945-9) Avail: NTIS HC A02/MF A01; HMOS £1.50; PHI

Detailed measurements were made of the casing boundary layer flow before and after the nozzle blades of a single stage model air turbine. The measurements were made with the natural casing inlet boundary layer and two artificially thickened boundary layers. The results differ considerably from those usually obtained in two dimensional cascades. There was no sign of the usual secondary loss core and for the thick boundary layers the circumferentially average total pressure increased along stream surfaces near to the casing, this implies a negative secondary loss. The explanation appears to be that low energy fluid from the upstream casing boundary layer is transported radially inwards along the blade surface or wake and is discharged into the mainstream over the whole of the blade span. Author

N77-28121# Aeronautical Research Council, London (England).
THE EFFECT OF TEMPERATURE ON SUBSONIC JET NOISE
B. J. Cocking (Natl. Gas Turbine Estab., Farnborough, Engl.) 1975 41 p refs Supersedes NGTER-331 and ARC 35575
(ARC-R/M-3771; NGTER-331; ARC-35575; ISBN-0-11-4709165) Avail: NTIS HC A03/MF A01; HMSO £3.50; PHI

The noise levels produced by hot and cold subsonic jets were measured using a convergent circular nozzle in an anechoic chamber. The effects of jet temperature on the sound power, the overall sound pressure levels, and the spectra of the jet noise are presented. Results show an unexpected increase in noise with increasing jet temperature at low jet velocities. The possibility of observation arising from sources upstream of the nozzle exit is considered and discounted. It is concluded that both the spectral shapes and the overall sound pressure level of a hot jet are significantly affected by refraction of the sound jet. The overall sound pressure levels were correlated to form the basis of a method for the prediction of the noise from static jets.
Author

N77-28122*# General Electric Co., Evendale, Ohio. Aircraft Engine Group.
ATTENUATION OF UPSTREAM-GENERATED LOW FREQUENCY NOISE BY GAS TURBINES Final Report
V. L. Doyle and R. K. Matta Aug. 1977 232 p refs
(Contract NAS3-19435)
(NASA-CR-135219; R77AEG482) Avail: NTIS HC A11/MF A01 CSCL 20A

The acoustic transfer functions of low frequency (below 3500 Hz) noise through aircraft turbines were investigated. Model test results were compared with theoretical predictions in order to assess the validity of the theory. Component tests were conducted on both high pressure and low pressure model turbines. The influence of inlet temperature and turbine speed attenuation was evaluated, while the effects of turbine pressure ratio, blade-row choking, and additional downstream stages were determined. Preliminary identification of pertinent aeroacoustic correlating parameters was made.
Author

N77-28123*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FULL-SCALE ALTITUDE ENGINE TEST OF A TURBOFAN EXHAUST-GAS-FORCED MIXER TO REDUCE THRUST SPECIFIC FUEL CONSUMPTION
Richard R. Cullom and Roy L. Johnson Jul. 1977 31 p refs
(NASA-TM-X-3568; E-9111) Avail: NTIS HC A03/MF A01 CSCL 21E

The specific fuel consumption of a low-bypass-ratio, confluent-flow, turbofan engine was measured with and without a mixer installed. Tests were conducted for flight Mach numbers from 0.3 to 1.4 and altitudes from 10,670 to 14,630 meters (35,000 to 48,000 ft) for core-stream-to-fan-stream temperature ratios of 2.0 and 2.5 and mixing-length-to-diameter ratios of 0.95 and 1.74. For these test conditions, the reduction in specific fuel consumption varied from 2.5 percent to 4.0 percent. Pressure loss measurements as well as temperature and pressure surveys at the mixer inlet, the mixer exit, and the nozzle inlet were made.
Author

N77-28124*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL INVESTIGATION OF A SWEPT-STRUT FUEL-INJECTOR CONCEPT FOR SCRAMJET APPLICATION
Griffin Y. Anderson, Patricia G. Reagon, Paul B. Gooderum, and W. Roger Russin Washington Aug. 1977 65 p refs
(NASA-TN-D-8454; L-11050) Avail: NTIS HC A04/MF A01 CSCL 21E

Results are presented of an experiment to investigate the behavior at Mach 4 flight conditions of the swept-strut fuel-injector concept employed in the Langley integrated modular scramjet engine design. Autoignition of the hydrogen fuel was not achieved at stagnation temperatures corresponding to a flight Mach number of 4; however, once ignition was achieved, stable combustion was maintained. Pressure disturbances upstream of the injector location, which were caused by fuel injection and combustion, were generally not observed; this indicates the absence of serious adverse combustor-inlet interactions. Mixing performance and reaction performance determined from probe surveys and wall pressure data indicate that high combustion efficiency should be obtained with the combustor length provided in the scramjet engine design. No adverse interaction between the perpendicular and parallel fuel-injection modes was observed.
Author

N77-28125*# Purdue Univ., Lafayette, Ind. Thermal Sciences and Propulsion Center.
STAGNATION REGION GAS FILM COOLING SPANWISE ANGLED COOLANT INJECTION Technical Report, May 1974 - Oct. 1976
David W. Luckey and Mel R. Lecuyer Dec. 1976 355 p refs
(Grant NGR-15-005-147; Contract N00014-75-C-0873)
(NASA-CR-153398; AD-A035716; TSPC-TR-76-2) Avail: NTIS HC A16/MF A01 CSCL 21/5

This experimental investigation involved the study of gas film cooling from a single row of spanwise angled holes using the stagnation region of a cylinder in cross flow to model the leading edge of a turbine vane. The objective was to obtain data for the local convective heat transfer rates to a highly cooled, curved surface exposed to a turbulent hot mainstream flow and a secondary, film coolant flow. Since the leading edge of the first stage, inlet turbine vane experiences some of the most severe thermal loads found in the turbine engine, effective film cooling is most important in this area. Film cooling of the leading edge area was modeled by making heat transfer measurements on the front stagnation region of cylinder in cross flow. Experiments were conducted in a rectangular duct using a film cooled cylindrical test surface normal to a two-dimensional freestream flow. A gas turbine combustor provided heated air flow to simulate a Reynolds number typical of a high pressure, high temperature turbine vane. Internal convection cooling of the cylinder allowed a gas-to-wall temperature ratio of 2.1 to be achieved while using a moderate freestream gas temperature 1000 R 444 K. The film coolant was chilled to obtain a coolant-to-freestream density ratio of 2.2, representative of the

gas turbine environment. The cylindrical test surface was instrumented with miniature heat flux gages, and wall thermocouples to determine the influence of the film coolant blowing ratio and the injection hole geometry on the film cooling performance. GRA

N77-28126# General Electric Co., Cincinnati, Ohio.
SUPERSONIC JET EXHAUST NOISE INVESTIGATION. VOLUME 2: TECHNICAL REPORT
Paul R. Knott, R. Mani, C. L. Merkle, H. S. Ribner, and P. Scott Jul. 1976 393 p refs
(Contract F33615-73-C-2031)
(AD-A038613; R74AEG452-Vol-2; AFAPL-TR-76-68-Vol-2) Avail: NTIS HC A17/MF A01 CSCL 20/1

This report discusses detailed accounts of major theoretical and experimental investigations directed toward obtaining better understanding and mathematical specification of supersonic turbulent jets. Complete theoretical discussions are given describing the influence of a jet's mean flow shrouding on acoustic radiation of heated and unheated jets; approximate closed form acoustic expressions for turbulent mixing noise characterized by self-noise and shear-noise are given; and theoretical aeroacoustic formulations for the orderly structure of supersonic jets are reviewed. Extensive theory/data comparisons of developed acoustic models are given. Experimental investigations aimed at studying high velocity jet refraction, and the influence of jet swirl and upstream combustion roughness on jet noise is presented. Additionally, an extensive series of laser velocimeter measurements for high velocity and high temperature simple circular jets is discussed. Results include hot-film/laser velocimeter comparisons for ambient jets, mean velocity and turbulent velocity, plume surveys of heated supersonic shock-free and shocked flow nozzles, and a demonstration experiment illustrating the capability of performing in-jet turbulence to far-field acoustic cross-correlation. Author (GRA)

N77-28127# General Electric Co., Cincinnati, Ohio.
SUPERSONIC JET EXHAUST NOISE INVESTIGATION. VOLUME 3: COMPUTER USERS MANUAL FOR AEROACOUSTIC PREDICTIONS Final Technical Report, 1 Dec. 1972 - 23 Sep. 1975
David R. Ferguson, Michael A. Smith, and Paul R. Knott Jul. 1976 701 p refs
(Contract F33615-73-C-2031)
(AD-A038614; R74AEG452-Vol-3; AFAPL-TR-76-68-Vol-3) Avail: NTIS HC A99/MF A01 CSCL 20/1

This report gives a detailed description of aerodynamic (Shock-free/Shocked flow) and acoustic turbulent mixing computer prediction programs developed by the General Electric Company for subsonic and supersonic simple exhaust jets. In addition to giving detailed descriptions of the aeroacoustic formulations and discussions of computer manual instructions for operating the program, extensive theory/data comparisons are given, as well as computer program listings and sample test cases. Author (GRA)

N77-28128# General Electric Co., West Lynn, Mass. Aircraft Engine Group.
REFINEMENT OF CASTING TECHNIQUES FOR SMALL AIR-COOLED, TURBINE BLADES, PHASE 1 Final Report, Sep. 1973 - Dec. 1975
G. Steele Irons Feb. 1977 40 p refs
(Contract DAAJ02-73-C-0106)
(AD-A038561; USAAMRDL-TR-76-37) Avail: NTIS HC A03/MF A01 CSCL 21/5

T700 stage-two turbine blade was redesigned to permit application of advanced coring practices to investment cast turbine blades. The redesign resulted in a more producible turbine blade and reduced the overall cost of the blade. The design history, manufacturing steps, qualification procedures, engine test results and cost analysis are discussed for the radial-hole cooled turbine blade. Author (GRA)

N77-28129# General Motors Corp., Indianapolis, Ind. Detroit Diesel Allison Div.
LOW-EMISSIONS COMBUSTOR DEMONSTRATION Final Report, 1 Mar. 1974 - 31 Dec. 1975
D. L. Troth Mar. 1977 405 p refs
(Contract DAAJ02-74-C-0025)
(AD-A038550; DDA-EDR-8723; USAAMRDL-TR-76-29) Avail: NTIS HC A18/MF A01 CSCL 21/5

The objectives of this eighteen-month program were to further develop two low-emission combustors-the prechamber combustor and the modified conventional combustor, to install them in a Detroit Diesel Allison Model 250-C20B engine, and to evaluate their performance in an engine environment. The combustors were to retain the 50% overall reduction in gas turbine mass emissions with no increase in any individual pollutant when tested over a typical Army light observation helicopter (LOH) duty cycle. GRA

N77-28130# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE ELECTROSTATIC SENSING OF SIMULATED MA-1A GAS PATH DISTRESSES M.S. Thesis
Robert Wesley Dunn Dec. 1976 77 p refs
(AD-A038527; AFIT/GNE/PH/76-2) Avail: NTIS HC A05/MF A01 CSCL 14/2

Jet engine distresses were simulated using a MA-1A start cart. Three primary methods were used to distress the gas turbine engine. Material was ingested through the compressor intake, the compressor section was rubbed with an aluminum rod, and foreign material was burned in the combustor can. The current wave forms created by these distresses were observed with four separate detectors. Since the MA-1A was on rubber tires, the current between the chassis and ground could be measured. This chassis current was equal to the rate at which charge was expelled in the exhaust. A Gaussian ring around the exhaust port provided a second way of detecting charges leaving the start cart. The third and fourth devices were an ion probe and a screen that were placed in the exhaust. GRA

N77-28131# Massachusetts Inst. of Tech., Cambridge. Gas Turbine Lab.
STUDIES ON TRANSONIC TURBINES WITH FILM-COOLED BLADES Annual Technical Report, 1 Jul. 1975 - 30 Jun. 1976
H. O. Demuren, N. Adams, F. Hajjar, O. M. Amana, and Jean F. Louis Jun. 1976 110 p refs
(Contract N00014-67-A-0204-0079)
(AD-A036402; TR-76-1; ATR-3) Avail: NTIS HC A06/MF A01 CSCL 21/5

In the third year of the contract, further advances were made towards the goal of gathering the heat transfer and aerodynamics flow data necessary for a good understanding of the performance of film-cooled, highly-loaded, transonic turbine blading. The MIT cascade blowdown facility now fully operational was used in evaluating the heat transfer performance of the four blade profiles designed in the first year of the program. The results show that the level of turbulence is an important parameter in determining heat transfer in transonic cascades. It also shows that the heat transfer to the trailing edge of the blades is very high being about 75% of the heat transfer to the leading edge. A comparison of the Nusselt number calculated from heat transfer measurements with the Nusselt number obtained by a prediction method using the pressure distribution shows good correspondence. The variation of average Stanton number over a range of Mach numbers shows that the reference blade has the most superior heat transfer performance. Preliminary data has been obtained on the off-design performance of the blades and full scale tests are underway. Comparative studies show that about 21% less heat needs to be taken out by internal cooling if one stage of a transonic turbine is used to replace two moderately loaded subsonic stages which produce the same output, have the same inlet stagnation conditions, have the same mass flow and the same tip speed. This demonstrates one of the potential advantages of transonic turbines. GRA

N77-28132# Detroit Diesel Allison, Indianapolis, Ind.
COMPRESSOR STATOR TIME-VARIANT AERODYNAMIC RESPONSE TO UPSTREAM ROTOR WAKES Interim Report
Sanford Fleeter, Robert L. Jay, and William A. Bennett Nov. 1976 121 p refs
(Contract F44620-74-C-0065; AF Proj. 9781)

(AD-A036343; DDA-EDR-9005; AFOSR-77-0066TR) Avail: NTIS HC A02/MF A01 CSCL 21/5

An experimental investigation was conducted to determine the fluctuating pressure distribution on a stationary vane row, with the primary source of excitation being the wakes from the upstream rotor blades. This was accomplished in a large scale, low speed, single stage research compressor. The forcing function, the velocity defect created by the rotor wakes, was measured with a crossed hot-wire probe. The aerodynamic response on the vanes was measured by means of flush mounted high response dynamic pressure transducers. The dynamic data were analyzed to determine the chordwise distribution of the dynamic pressure coefficient and aerodynamic phase lag as referenced to a transverse gust at the vane leading edge. Vane suction and pressure surface data as well as the pressure difference across the vane were obtained for reduced frequency values ranging from 3.65 to 16.80 and for incidence angles from -4.5 to -31.0 deg. The pressure difference data were correlated with a state-of-the-art aerodynamic cascade transverse gust analysis.
Author (GRA)

N77-28133# California Inst. of Tech., Pasadena. Guggenheim Jet Propulsion Center.
ANALYTICAL STUDIES OF SOME ACOUSTIC PROBLEMS OF JET ENGINES Ph.D. Thesis. Interim Report
Sebastien M. Candel Washington DOT May 1976 240 p refs
(Contract DOT-OST-20197)
(PB-264918/4; DOT-TST-76-104) Avail: NTIS HC A11/MF A01 CSCL 21E

The propagation and generation of acoustic waves in a choked nozzle is considered where pressure and entropy fluctuations caused by gas stream non-uniformities like hot spots, are incident on the nozzle entrance. A noise-generation mechanism is found which produces acoustic waves of strength proportional to the entrance entropy fluctuation and local gradient of the mean flow velocity. A transformation is introduced which relates the solutions of problems involving the propagation of acoustic waves in a moving medium to the solutions of associated problems in a stationary medium.
GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N77-28134 Aeronautical Research Labs., Melbourne (Australia).
THE EFFECT OF SPANWISE GUST VARIATIONS ON THE TRANSFER FUNCTION OF AN AIRCRAFT MODEL WITH ONE DEGREE OF FREEDOM
Douglas John Sherman Aug. 1976 31 p refs
(ARL-Struc-Note-431; AR-228) Copyright. Avail: Issuing Activity

Charts are derived for the determination of the power spectrum parameters (a standard deviation of vertical acceleration at aircraft center of gravity/standard deviation of vertical gust velocity and N sub 0 rate of level crossings of mean value), due to atmospheric turbulence. The method takes account of spanwise variations in gust loading, and so overcomes the paradox of an infinite N sub 0 which is found with a one-dimensional gust model.
Author

N77-28135*# Kansas Univ. Center for Research, Inc., Lawrence.
FLIGHT EVALUATION OF A SPOILER ROLL CONTROL SYSTEM ON A LIGHT TWIN-ENGINE AIRPLANE
David L. Kohlman Dec. 1976 50 p refs
(Grant NsG-1227)
(NASA-CR-154121; KU-FRL-203) Avail: NTIS HC A03/MF A01 CSCL 01C

Slot lip spoilers were designed, installed, and flight tested on a modified Piper PA34-200 aircraft. Data obtained during in-flight monitoring are presented and discussed. Topics include: configuration description, instrumentation, spoiler roll characteristics, and wheel deflections and forces.
A.R.H.

N77-28136*# Old Dominion Univ. Research Foundation, Norfolk, Va.
EXPERIMENTAL AND ANALYTICAL INVESTIGATIONS TO IMPROVE LOW-SPEED PERFORMANCE AND STABILITY AND CONTROL CHARACTERISTICS OF SUPERSONIC CRUISE FIGHTER VEHICLES Final Report
A. B. Graham Jun. 1977 5 p
(Grant NsG-1309)
(NASA-CR-154122) Avail: NTIS HC A02/MF A01 CSCL 01C

Small- and large-scale models of supersonic cruise fighter vehicles were used to determine the effectiveness of airframe/propulsion integration concepts for improved low-speed performance and stability and control characteristics. Computer programs were used for engine/airframe sizing studies to yield optimum vehicle performance.
Author

N77-28137*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT INVESTIGATION OF A VERTICAL-VELOCITY COMMAND SYSTEM FOR VTOL AIRCRAFT
James R. Kelly, Frank R. Niessen, Kenneth R. Yenni, and Lee H. Person, Jr. Washington Jul. 1977 26 p refs
(NASA-TN-D-8480; L-11454) Avail: NTIS HC A03/MF A01 CSCL 01C

A flight investigation was undertaken to assess the potential benefits afforded by a vertical-velocity command system (VVCS) for VTOL (vertical take-off and landing) aircraft. This augmentation system was conceived primarily as a means of lowering pilot workload during decelerating approaches to a hover and/or landing under category III instrument meteorological conditions. The scope of the investigation included a determination of acceptable system parameters, a visual flight evaluation, and an instrument flight evaluation which employed a 10 deg, decelerating, simulated instrument approach task. The results indicated that the VVCS, which decouples the pitch and vertical degrees of freedom, provides more accurate glide-path tracking and a lower pilot workload than does the unaugmented system.
Author

N77-28138*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A THEORETICAL ANALYSIS OF AIRPLANE LONGITUDINAL STABILITY AND CONTROL AS AFFECTED BY WIND SHEAR
Windsor L. Sherman Washington Jul. 1977 53 p refs
(NASA-TN-D-8496; L-11392) Avail: NTIS HC A04/MF A01 CSCL 01C

The longitudinal equations of motion with wind shear terms were used to analyze the stability and motions of a jet transport. A positive wind shear gives a decreasing head wind or changes a head wind into a tail wind. A negative wind shear gives a decreasing tail wind or changes a tail wind into a head wind. It was found that wind shear had very little effect on the short period mode and that negative wind shear, although it affected the phugoid, did not cause stability problems. On the other hand, it was found that positive wind shear can cause the phugoid to become aperiodic and unstable. In this case, a stability boundary for the phugoid was found that is valid for most aircraft at all flight speeds. Calculations of aircraft motions confirmed the results of the stability analysis. It was found that a flight path control automatic pilot and an airspeed control system provide good control in all types of wind shear. Appendixes give equations of motion that include the effects of downdrafts and updrafts and extend the longitudinal equations of motion for shear to six degrees of freedom.
Author

N77-28139*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN INVESTIGATION OF A CLOSE-COUPLED CANARD AS A DIRECT SIDE-FORCE GENERATOR ON A FIGHTER MODEL AT MACH NUMBERS FROM 0.40 TO 0.90
Richard J. Re and Francis J. Capone Washington Jul. 1977 37 p refs
(NASA-TN-D-8510; L-11613) Avail: NTIS HC A03/MF A01 CSCL 01C

The canard panels had 5 deg of dihedral and were deflected differentially or individually over an incidence range from 10 deg to -10 deg and a model angle-of-attack range from -4 deg to

15 deg. Significant side forces were generated in a transonic tunnel by differential and single canard-panel deflections over the Mach number and angle-of-attack ranges. The yawing moment resulting from the forward location of the generated side force would necessitate a vertical tail/rudder trim force which would augment the forebody side force and be of comparable magnitude. Incremental side forces, yawing moments, lift, and pitching moments due to single canard-panel deflections were additive; that is, their sums were essentially the same as the forces and moments produced by differential canard-panel deflections of the same magnitude. Differential and single canard-panel deflections produced negligible rolling moments over the Mach number and angle-of-attack ranges. Author

N77-28140# Boeing Vertol Co., Philadelphia, Pa.
THE CH-47C VULNERABILITY REDUCTION MODIFICATION PROGRAM: FLY-BY-WIRE BACKUP DEMONSTRATION Final Report, Jul. 1975 - Mar. 1976
Bruce McManus and Joseph Gonsalves Aug. 1976 157 p refs
(Contract DAAJ02-75-C-0052; DA Proj. 1F2-62209-AH-76)
(AD-A030682; D210-11046-1; USAAMRDL-TR-76-22) Avail: NTIS HC A08/MF A01 CSCL 01/3

The purpose of the work performed was to accomplish a laboratory demonstration of a fly-by-wire (FBW) backup flight control system for application to the CH-47C helicopter. Tests, evaluations, and an analysis were conducted to determine the feasibility of using an electrical linkage as a backup to the existing mechanical flight control system. Of primary concern was the interfacing technique between the two systems, which was to result in no degradation of control system performance during normal operation and which would permit safe operation of the aircraft in the event of a failure in either the mechanical or the FBW backup system. The program was performed in four tasks. Task I involved the definition of a FBW backup system based on use of HLH ATC components suitable to demonstrate concept feasibility on the Boeing Iron Bird flight control test rig. Task II involved the modification and installation of the system on the test rig with the actual testing and performance evaluation being conducted during Task III. Task IV effort involved the reassessment of effects analysis conducted under Contract DAAJ02-74-C-0052. Author (GRA)

N77-28141# Human Engineering Labs., Aberdeen Proving Ground, Md.
HELICOPTER INTEGRATED CONTROL (GAT-2H) Final Report
John D. Waugh and John A. Stephens Dec. 1976 33 p refs
(AD-A036204; HEL-TM-39-76) Avail: NTIS HC A03/MF A01 CSCL 01/3

Two experimental three-axis helicopter controls combining collective and cyclic functions into an optional one-handed controller were simulator flight tested and their performance, measured in energy-expended terms, was compared to conventional helicopter controls. The nature of the results indicates that further development through flight testing should be undertaken. Author (GRA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N77-28142 Polish Academy of Sciences, Warsaw.
THE ZMCiG SHOCK TUBE [RURA UDERZENIOWA ZMCiG]
Z. A. Walenta, A. S. Gmurczyk, W. W. Harasimowicz, E. M. Leskiewicz, M. Tarczynski, J. Orzenski, and K. J. Salgut Dec. 1976 26 p refs In POLISH
Avail: Issuing Activity

In a relatively short time (1.5 hours), the tube can be exhausted to a pressure of 0.000005 Tr. When the pump is disconnected, an infiltration of 0.000002 Tr is registered. Since the experiment preparation time starting with the disconnection of the pump is over five minutes, a partial pressure of impurities no higher than 0.000015 Tr is obtained. With an initial pressure of 0.002 Tr, the distance between the shock wave and the surface of the partitition is approximately equal to the diameter of the tube, i.e., about 250 mm. This is large enough to conduct an experiment. At that pressure, the average free path in front of the shock wave for gases such as argon and nitrogen is about 2.5 mm. This makes it possible to observe phenomena whose characteristic size is of the same order or larger and phenomena in the transitory range. Author

N77-28143*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
CRYOGENIC DESIGN AND SAFETY REVIEW NASA-LANGLEY RESEARCH CENTER 0.3 METER TRANSONIC CRYOGENIC TUNNEL
R. O. Voth and T. R. Strobridge Apr. 1977 28 p refs Sponsored by NASA
(NASA-TM-74767; NBSIR-77-857) Avail: NTIS HC A03/MF A01 CSCL 14B

A cryogenic design and safety review of a 0.3 m transonic cryogenic tunnel is presented. The tunnel working fluid and coolant is nitrogen. The nitrogen, supplied as liquid, is exhausted as a low temperature gas. The tunnel and ancilliary systems are generally well designed but several recommendations to improve the cryogenic systems are made. The cost of recovering the cold vent gas is compared to the cost of producing the required liquid nitrogen using a captive air separation plant. Although the economic analysis is preliminary, it shows that because of the periodic operation of the tunnel, a captive air separation plant has a lower annual operating cost than the vent gas recovery systems considered. Author

N77-28144# Aeronautical Research Council, London (England).
UREA FORMADEHYDE FOAMED PLASTIC EMERGENCY ARRESTERS FOR CIVIL AIRCRAFT
G. M. Gwynne (RAE, Bedford, England) 1975 62 p refs Supersedes RAE-TR-74002 and ARC-35771
(ARC-CP-1329; RAE-TR-74002; ARC-35771; ISBN-011-470939-4) Avail: NTIS HC A04/MF A01; HMSO £2.20;PHI

Arresting trials with a Comet 3B aircraft at its maximum landing mass of 54,400 kg at speeds up to 56 kn in test beds of urea formaldehyde foam of varying depth, length and density are described. The main conclusions from the trials are that retardation of the aircraft in the arrester is independent of entry speed, and significant drag is contributed by both the leading and trailing wheels of a bogie arrangement and the drag is predictable. The performance of the arrester is unaffected by the application of antiskid controlled wheel brakes. The foam causes no significant damage to turbine engines or aircraft structure, and the addition of a foam lead in gradient to the full depth foam bed reduces the ratio of peak to mean retardation. A number of minor conclusions are also presented. Design examples for foam arresters demonstrating that it should be possible to devise configurations, suitable for airfields where overrun hazards exist, for arresting aircraft safety without overstressing undercarriage units due to the foam drag loads are also included. Author

N77-28145*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FORCE TESTING MANUAL FOR THE LANGLEY 20-INCH MACH 6 TUNNEL
J. Wayne Keyes Jul. 1977 100 p
(NASA-TM-74026) Avail: NTIS HC A05/MF A01 CSCL 14B

Data reduction and procedures for conducting force tests in a 20 inch Mach 6 tunnel are described. A discussion of pretest and testing phases are included. Items that are to be checked during model design and construction are outlined as well as safety requirements, starting loads tests, instructions for data acquisition and model installation. Measurement of balance and model misalignment and instructions for calibrating the angle of attack screen are covered. Procedures for making reference pressure, attitude tare, and data runs are included. The 20 inch

tunnel force program is examined, and a description of data recording system input and load contrast sheets is given. An appendix presents a description, operating characteristics, and Mach number calibration of the tunnel, as well as tunnel characteristics. Author

N77-28146# Illinois Univ., Urbana-Champaign. Savoy Aviation Research Lab.
SIMULATORS FOR TRAINING AND PROFIT
Charles O. Hopkins Jul. 1976 10 p refs
(Contract F44620-76-C-0009)
(AD-A038190; ARL-76-10/AFOSR-76-5; AFOSR-77-0373TR) Avail: NTIS HC A02/MF A01 CSCL 05/9

The use of simulators for training and profit is discussed in terms of the concept of cost effectiveness. Increased degree and fidelity of simulation require greater equipment complexity and cost. Data are presented that show a high negative correlation between cost and field reliability of avionics equipment. There is a paucity of research data on the relationships between simulator fidelity and transfer effectiveness. The results of the first and only recently completed experiment to investigate transfer of initial flight training as a function of simulator cockpit motion are summarized. A rational basis for simulator selection and use developed by Jacobs and Roscoe is presented. The need for research to establish relationships between transfer of training and physical characteristics such as degree and fidelity of simulation is seen as critical to the widespread future use of simulators for training and profit. Author (GRA)

N77-28147# Illinois Univ., Urbana-Champaign. Savoy Aviation Research Lab.
SIMULATOR COCKPIT MOTION AND THE TRANSFER OF INITIAL FLIGHT TRAINING
Robert S. Jacobs Jun. 1976 90 p refs
(Contract F44620-76-C-0009)
(AD-A038194; ARL-76-8/AFOSR-76-4; AFOSR-77-0380TR) Avail: NTIS HC A05/MF A01 CSCL 05/9

Transfer of flight training from a Singer-Link GAT-2 training simulator, modified to approximate a counterpart Piper Cherokee Arrow airplane, was measured for independent groups of nine flight-naive subjects, each trained in one of three simulator cockpit motion conditions: normal washout motion in bank with sustained pitch angles, washout banking motion in which the direction of motion relative to that of the simulated airplane was randomly reversed 50% of the time as the cab passed through a wings-level attitude, and a fixed-base condition. Subjects received predetermined fixed amounts of practice in the simulator on each of 11 flight maneuvers drawn from the Private Pilot flight curriculum. Transfer performance measures, including flight time and trials to FAA performance criteria and total errors made in the process, showed reliable transfer for all groups with differential transfer effects and cost effectiveness implications depending upon the type of simulator motion. An aptitude estimator measure and the analysis of covariance technique provided increased discrimination among groups in the presence of considerable individual variation in performance within treatment conditions.
Author (GRA)

N77-28148# ARO, Inc., Arnold Air Force Station, Tenn.
DESIGN CONCEPT INVESTIGATION TO MINIMIZE COSTS OF A HYPERVELOCITY TRACK Final Report, 21 Jan. 1975 - 26 Mar. 1976
George W. Hyslip Apr. 1977 82 p
(AD-A039017; AEDC-TR-76-132; ARO-VKF-TR-76-87) Avail: NTIS HC A05/MF A01 CSCL 20/4

Typical sections of a prototype hypervelocity track installed in a thin-wall tube for an ablation/erosion chamber were designed, fabricated, and tested as a part of an overall cost reduction study for a Proposed Reentry Vehicle Ground Test Facility. An estimated cost savings of 40 to 50 percent may be realized utilizing test results obtained in the present investigation. The original cost estimate was based on conventional and proved concepts for maintaining rail position and straightness which depends on heavy wall tubes with rails fully supported over their full length. The reduced cost concept utilizes a thin-wall vessel with the rails simply supported near the connecting flanges only. Rail alignment and displacement measurements were obtained under varying conditions that would occur in actual operation of such a facility. Author (GRA)

N77-28149# Naval Civil Engineering Lab., Port Hueneme, Calif.
EXPEDIENT STRUCTURAL SANDWICH SOIL SURFACING OF FIBERGLASS REINFORCED POLYESTER AND POLYURETHANE FOAM Technical Note, Jun. 1973 - Jun. 1976
M. C. Hironaka, R. B. Brownie, and S. Tuccillo Feb. 1977 66 p refs
(AD-A038417; CEL-TN-1472) Avail: NTIS HC A04/MF A01 CSCL 13/13

A structural soil surfacing (FOMAT), consisting of a rigid polyurethane foam core sandwiched between two fiberglass reinforced plastic (FRP) layers, is being developed to fulfill a need for a designable, heavy-duty, expedient surfacing for Marine Corps amphibious landing applications. In analytical and laboratory investigations, FOMAT showed very good potential for meeting expedient surfacing requirements. The FOMAT constructed of 15- and 20-pcf-density foams will adequately carry F4 aircraft wheel loadings as determined from finite element computer analyses and plate loading tests in a mechanical simulated subgrade. Tests performed on FOMAT with 20-pcf foam core showed that it meets or exceeds F4 aircraft arresting gear hook/impact and jet engine heat/blast performance specifications for a heavy-duty matting. Construction of FOMAT under field conditions indicated a problem with bonding of the polyurethane foam core and the bottom FRP layer, causing premature termination of simulated F4 aircraft wheel traffic tests on eight FOMAT panels located on heavy clay, lean clay, and sand soils. FOMAT panels consisting of 15- and 20-pcf density and 1- and 2-inch-thick foam cores were subjected to the traffic loadings. At a maximum of 40 passes on two panels of 2-inch-thick 15-pcf and 2-inch-thick 20-pcf foam core, a wheel deflection of 1 inch on the FOMAT surface was experienced. Development of field construction techniques to insure a positive bond between the foam core and bottom FRP layer is recommended.
Author (GRA)

N77-28150# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
TECHNIQUES FOR THE INITIAL EVALUATION OF FLIGHT SIMULATOR EFFECTIVENESS M.S. Thesis
Ralph L. Miller Dec. 1976 105 p refs
(AD-A036460; GSM/SM/76D-34) Avail: NTIS HC A06/MF A01 CSCL 14/2

This report presents an analysis of the development and initial evaluation of Air Force flight simulators. The objectives of the study were to determine the criterion variables most applicable to an initial flight simulator evaluation and to develop a general technique for the evaluation of these criterion variables. The research began with a review of current Navy, Army, and Air Force flight simulator development and evaluation techniques. This review, combined with information gathered from related sources, provided the basis for examination and selection of criterion variables. The variables examined by this effort were: aircraft flight time saved, training efficiency, transfer of training, fidelity of psychological simulation, fidelity of engineering simulation, and simulator effectiveness. The examination of these variables concentrated on their measurability during an initial flight simulator evaluation and their ability to predict how well a flight simulator would perform its intended mission. Following the examination of criterion variables, the research concentrated on the development of a technique for the evaluation of applicable criterion variables. The resulting technique is a combination of the traditional quantitative techniques plus some subjective techniques. The purpose of the subjective techniques is to identify simulator characteristics that are perceived to be different from the real work aircraft characteristics and to assess the impact that these differences will have on the operational use of the flight simulator. Author (GRA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N77-28151*# Grumman Aerospace Corp., Bethpage, N.Y.
ORBITAL CONSTRUCTION DEMONSTRATION STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
Jun. 1977 67 p
(Contract NAS9-14916)
(NASA-CR-151465; NSS-OC-RP012-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 22A

A conceptual design and program plan for an Orbital Construction Demonstration Article (OCDA), that can be used for technology growth and verification, and as the construction facility for a variety of large structures is presented. The OCDA design includes a large work platform, a rotating manipulator boom, a 250 kw solar array, and a core module of subsystems with a total mass of 37,093 kg, that can be assembled in three shuttle flights. An analysis of OCDA continued utility potential indicates that a shuttle tended platform with 250 kW of power can effectively be used to construct highly beneficial antenna systems and large demonstration articles that advance solar power satellite technologies. The construction of 100 m parabolic reflectors for use as a radiometer for measuring soil moisture and water salinity was found to be within the capabilities of OCDA concept. With 252 fixed beams for high population centers, and 16 scanning beams for rural areas, the antenna has the potential to significantly improve U.S. space based communications systems. The OCDA, that is slightly increased in size, was found adequate to build a large 2 MW solar array which, when coupled to a transmit antenna, demonstrate power transfer from space to ground. Author

N77-28152*# Grumman Aerospace Corp., Bethpage, N.Y.
ORBITAL CONSTRUCTION DEMONSTRATION STUDY. VOLUME 2: TECHNICAL Final Report
Jun. 1977 342 p refs
(Contract NAS9-14916)
(NASA-CR-151467; NSS-OC-RP012-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 22A

The following items are discussed in reference to OCDA requirements: (1) flight mechanics and control, (2) effects of sun angle, (3) disturbance torques, (4) control system requirements, (5) OCDA orbit decay profile, and (6) aerodynamic drag forces. Structural design requirements are also given as well as basic design definition. B.B.

N77-28153*# Grumman Aerospace Corp., Bethpage, N.Y.
ORBITAL CONSTRUCTION DEMONSTRATION STUDY. VOLUME 3: REQUIREMENTS DOCUMENT Final Report
Jun. 1977 96 p refs
(Contract NAS9-14916)
(NASA-CR-151466; NSS-OC-RP012-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 22A

A comprehensive set of requirements that defines the objective, scope and configuration of the orbital test facility needed to demonstrate the necessary automated fabrication, construction and assembly technology is provided. In addition to the requirements for the orbital demonstration facility, a detailed list of experiment requirements is included for various areas of technology. Author

N77-28154*# TRW Defense and Space Systems Group, Houston, Tex. Systems Analysis Section.
FORMULATION OF CONSUMABLES MANAGEMENT MODELS. GUIDELINES FOR THE DEVELOPMENT OF CONSUMABLES SUBSYSTEM REDLINES FOR ADVANCED SPACECRAFT
M. A. Zamora 30 Jun. 1977 24 p refs
(Contract NAS9-14264)
(NASA-CR-151463; TRW-26821-H018-RO-00) Avail: NTIS HC A02/MF A01 CSCL 22A

Techniques developed for determining the safe operating range or condition of past space programs are inadequate to support requirements of highly repetitive and routine earth orbit operations of advanced spacecraft systems. General concepts are presented for establishing maximum and minimum limits (redlines) for the consumables subsystems of the space shuttle orbiter. Implementation of a redline status subprocessor is recommended as a substitute for methods employed in past programs. The algorithms developed are amenable for use in the Mission Control Center, the launch processing system, and the space shuttle onboard computer. Author

N77-28155*# Westinghouse Electric Corp., Pittsburgh, Pa.
GLASS FINING EXPERIMENTS IN ZERO GRAVITY Final Report, 10 Dec. 1976 - 30 Jun. 1977
H. D. Smith 30 Jun. 1977 58 p refs
(Contract NAS8-32351)
(NASA-CR-150342) Avail: NTIS HC A04/MF A01 CSCL 11B

Ground based experiments were conducted to demonstrate that thermal migration actually operated in glass melts. Thermal migration consistent with the theory was found in one experiment on a borax melt, i.e., there was an approximately linear relation between the bubble diameter and bubble velocity for a given temperature and temperature gradient. It also appeared that nearby bubbles were attracted to one another, which could greatly aid fining. Interpretation of these results was not possible because of complications arising from gravity, i.e., floating of the bubbles, circulation currents due to buoyancy-driven natural connection, and flow of the melt out from the cell. Author

N77-28156*# Martin Marietta Corp., Denver, Colo.
ATMOSPHERIC, MAGNETOSPHERIC AND PLASMAS IN SPACE (AMPS) SPACELAB PAYLOAD DEFINITION STUDY. VOLUME 2: MISSION SUPPORT REQUIREMENTS DOCUMENT Final Report
Nov. 1976 230 p
(Contract NAS8-31689)
(NASA-CR-152557; MCR-76-281-A-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 22A

The science objectives, the experiment and instrument requirements, and the total ground and mission related requirements to be implemented by GSFC and other NASA centers for each AMPS/Labcraft mission are defined. Author

N77-28157*# Martin Marietta Corp., Denver, Colo.
ATMOSPHERIC, MAGNETOSPHERIC AND PLASMAS IN SPACE (AMPS) SPACELAB PAYLOAD DEFINITION STUDY. VOLUME 3: INTERFACE CONTROL DOCUMENTS. PART 1: AMPS PAYLOAD TO SHUTTLE ICD Final Report
Nov. 1976 12 p
(Contract NAS8-31689)
(NASA-CR-152554; MCR-76-281-A-Vol-3; DR-SE-02-A-Vol-3-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 22A

Physical, functional, and operational interfaces between the space shuttle orbiter and the AMPS payload are described for the ground handling and test phases, prelaunch, launch and ascent, operational, stowage, and reentry and landing activities. Author

N77-28158*# Martin Marietta Corp., Denver, Colo.
ATMOSPHERIC, MAGNETOSPHERIC AND PLASMAS IN SPACE (AMPS) SPACELAB PAYLOAD DEFINITION STUDY. VOLUME 3: INTERFACE CONTROL DOCUMENTS. PART 2: AMPS PAYLOAD TO SPACELAB ICD Final Report
Nov. 1976 17 p
(Contract NAS8-31689)
(NASA-CR-152555; MCR-76-281-A-Vol-3; DR-SE-02-A-Vol-3-Pt-2) Avail: NTIS HC A02/MF A01 CSCL 22A

The AMPS to Spacelab Interface Control Document which is to be used as a guide for format and information content in generating specific AMPS Mission ICDs is presented. This document is meant to supplement the Spacelab Payload Accommodations Handbook in that it only defines interfaces which are not discussed in the handbook to the level required for design purposes. The AMPS Top Level Requirements Tree, illustrates this ICD by a shaded area and its relationship to the other AMPS technical documents. Other interface documents shown are the Level II, AMPS to Space Shuttle Vehicle ICD and the Level III, AMPS to Instruments ICD. Author

N77-28159*# Martin Marietta Corp., Denver, Colo.
ATMOSPHERIC, MAGNETOSPHERIC AND PLASMAS IN SPACE (AMPS) SPACELAB PAYLOAD DEFINITION STUDY.

VOLUME 3: INTERFACE CONTROL DOCUMENTS. PART 3: AMPS PAYLOAD TO INSTRUMENTS ICD Final Report
Nov. 1976 61 p
(Contract NAS8-31689)
(NASA-CR-152556; MCR-76-281-A-Vol-3-Pt-3; DR-SE-02-A-Vol-3-Pt-3) Avail: NTIS HC A04/MF A01 CSCL 22A

General physical, functional, and operational interface control requirements for instruments on the first AMPS payload are presented. Interface specifications are included to satisfy ground handling, prelaunch, launch, stowage, operation, and landing activities. Applicable supporting documentation to implement the information is also given. Author

N77-28160*# Martin Marietta Corp., Denver, Colo.
ATMOSPHERIC, MAGNETOSPHERIC AND PLASMAS IN SPACE (AMPS) SPACELAB PAYLOAD DEFINITION STUDY. VOLUME 4. PART 1, AMPS PROGRAM SPECIFICATION
J. T. Keeley Nov. 1976 75 p
(Contract NAS8-31689)
(NASA-CR-152558; MCR-76-281-A-Vol-4-Pt-1; DR-SE-03-A-Vol-4-Pt-1) Avail: NTIS HC A04/MF A01 CSCL 22A

The AMPS Program Specification delineates the AMPS Program requirements consistent with the resources defined in the AMPS Project Plan. All subsidiary specifications and requirements shall conform to the requirements presented. The requirements hierarchy for the AMPS program is illustrated. A brief description of each of the requirements documents and their intended use is provided. Author

N77-28161*# Martin Marietta Corp., Denver, Colo.
ATMOSPHERIC, MAGNETOSPHERIC AND PLASMAS IN SPACE (AMPS) SPACELAB PAYLOAD DEFINITION STUDY; VOLUME 4: PART 2, LABCRAFT PAYLOAD GENERAL SPECIFICATION
J. T. Keeley Nov. 1976 51 p
(Contract NAS8-31689)
(NASA-CR-152559; MCR-76-281-A-Vol-4-Pt-2; DR-SE-03-A-Vol-4-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 22A

The Labcraft Payload General Specification (LPGS) amplifies those general requirements in the Labcraft Program Specification (LPS) to ensure that all hardware, software, and STS elements will successfully function as an integrated system to accomplish the objectives of the first Labcraft mission. Contract End Item Specifications (CEIS) and Procurement Drawings (PDs) prepared and implemented for all deliverable hardware and software elements are discussed. Author

N77-28162*# Martin Marietta Corp., Denver, Colo.
ATMOSPHERIC, MAGNETOSPHERIC AND PLASMAS IN SPACE (AMPS) SPACELAB PAYLOAD DEFINITION STUDY; VOLUME 4: PART 3, LABCRAFT INSTRUMENT SYSTEMS GENERAL SPECIFICATION
J. T. Keeley Nov. 1976 89 p
(Contract NAS8-31689)
(NASA-CR-152560; MCR-76-281-A-Vol-4-Pt-3; DR-SE-03-A-Vol-4-Pt-3) Avail: NTIS HC A05/MF A01 CSCL 22A

Guidelines and general requirements applicable to the development of instrument flight hardware intended for use on the GSFC Shuttle Scientific Payloads Program are given. Criteria, guidelines, and an organized approach to specifying the appropriate level of requirements for each instrument in order to permit its development at minimum cost while still assuring crew safety, are included. It is recognized that the instruments for these payloads will encompass wide ranges of complexity, cost, development risk, and safety hazards. The flexibility required to adapt the controls, documentation, and verification requirements in accord with the specific instrument is provided. Author

N77-28163*# Martin Marietta Corp., Denver, Colo.
ATMOSPHERIC, MAGNETOSPHERIC AND PLASMAS IN SPACE (AMPS) SPACELAB PAYLOAD DEFINITION STUDY - PROGRAM ANALYSIS AND PLANNING FOR PHASE C/D DOCUMENT - VOLUME 7
J. T. Keeley Nov. 1976 182 p
(Contract NAS8-31689)
(NASA-CR-152561; MCR-76-281-A-Vol-7; DR-MA-04-A) Avail: NTIS HC A09/MF A01 CSCL 22A

Typical missions identified for AMPS flights in the arly 1980's are described. Experiment objectives and typical scientific instruments selected to accomplish these objectives are discussed along with mission requirements and shuttle and Spacelab capabilities assessed to determine any AMPS unique requirements. Preliminary design concepts for the first two AMPS flights form the basis for the Phase C/D program plan. This plan implements flights 1 and 2 and indicates how both the scientific and flight support hardware can be systematically evolved for future AMPS flights. Author

N77-28164*# Martin Marietta Corp., Denver, Colo.
AMPS SUPPORTING RESEARCH AND TECHNOLOGY (SR AND T) REPORT. ATMOSPHERIC, MAGNETOSPHERIC AND PLASMAS IN SPACE (AMPS) DEFINITION STUDY Final Support
Nov. 1976 48 p
(Contract NAS8-31689)
(NASA-CR-152553; MCR-76-279-A; DR-SE-243B) Avail: NTIS HC A03/MF A01 CSCL 22A

A listing of candidate technology areas that require additional study is presented. These candidate tasks, identified during the AMPS Phase B studies, are requisites to the design, development, and operation of the AMPS concept selected for preliminary design. Author

N77-28165*# Martin Marietta Corp., Denver, Colo.
ATMOSPHERIC, MAGNETOSPHERIC, AND PLASMAS IN SPACE (AMPS) SPACELAB PAYLOAD DEFINITION STUDY, TECHNICAL SUMMARY DOCUMENT
J. T. Keeley Nov. 1976 445 p refs
(Contract NAS8-31689)
(NASA-CR-152562; MCR-76-419A; DR-MA-03) Avail: NTIS HC A19/MF A01 CSCL 22A

Some 60 instrument candidates and 80 possible science investigations were evaluated. The early analysis emphasized the science aspect in terms of the functional requirements for each of the potential experiments identified by the AMPS science working group. These requirements were then used for the grouping of instruments into practical payloads which would fit the capabilities of the Shuttle/Spacelab. This analysis resulted in the definition of eleven different AMPS configurations. The data were then used to define a typical set of requirements for a flexible AMPS laboratory. The data gathered to this point showed that a planned sequential buildup of the laboratory would be necessary to meet both physical and funding limitations. This led to the definition of five strawman payloads by the science working group, which were used to establish a conceptual laboratory and to define preliminary design of a configuration which could satisfy AMPS needs during the early program period. Author

N77-28166*# Martin Marietta Corp., Denver, Colo.
ATMOSPHERIC, MAGNETOSPHERIC, AND PLASMAS IN SPACE (AMPS) SPACELAB PAYLOAD DEFINITION STUDY, APPENDIXES
J. T. Keeley Nov. 1976 155 p
(Contract NAS8-31689)
(NASA-CR-152563; MCR-76-419A-App; DR-MA-03-App) Avail: NTIS HC A08/MF A01 CSCL 22A

An equipment list, instrument baseline data, engineering drawings, mass properties computer printouts, electrical energy management, and control and display functional analysis pertinent to the AMPS (Satellite Payload) are presented. J.M.S.

N77-28167*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
ATMOSPHERE, MAGNETOSPHERE AND PLASMAS IN SPACE (AMPS). SPACE PAYLOAD DEFINITION STUDY. VOLUME 2: MISSION SUPPORT REQUIREMENTS DOCUMENT Final Report
Nov. 1976 128 p 8 Vol.
(Contract NAS8-31690)
(NASA-CR-152564; TRW-27615-6007-RU-00-Vol-2) Avail:

NTIS HC A07/MF A01 CSCL 22A

The flight payload, its operation, and the support required from the Space Transporatation System (STS) is defined including the flight objectives and requirements, the experiment operations, and the payload configurations. The support required from the STS includes the accommodation of the payload by the orbiter/Spacelab, use of the flight operations network and ground facilities, and the use of the launch site facilities. Author

N77-28168*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

ATMOSPHERE, MAGNETOSPHERE AND PLASMAS IN SPACE (AMPS). SPACELAB PAYLOAD DEFINITION STUDY. VOLUME 2: MISSION SUPPORT REQUIREMENTS DOCUMENT. ADDENDUM: FLIGHT 2 Final Report

Nov. 1976 69 p 8 Vol.
(Contract NAS8-31690)
(NASA-CR-152565; TRW-27615-6007-RU-00-Vol-2-Add) Avail: NTIS HC A04/MF A01 CSCL 22A

The AMPS Flight 2 payload, its operation, and the support required from the Space Transportation System (STS) are described. The definition of the payload includes the flight objectives and requirements, the experiment operations, and the payload configuration. The support required from the STS includes the accommodation of the payload by the orbiter/Spacelab, use of the flight operations network and ground facilities, and the use of the launch site facilities. Author

N77-28169*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

ATMOSPHERE, MAGNETOSPHERE AND PLASMAS IN SPACE (AMPS). SPACELAB PAYLOAD DEFINITION STUDY. VOLUME 3; BOOK 1: AMPS EQUIPMENT TO ORBITER ICD Final Report

Nov. 1976 12 p ref 8 Vol.
(Contract NAS8-31690)
(NASA-CR-152566; TRW-27615-6007-RU-01-Vol-3) Avail: NTIS HC A02/MF A01 CSCL 22A

The physical, thermal, and electrical interfaces that exist between Spacelab-AMPS Payload No.(TBD) and the orbiter are described. Author

N77-28170*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

ATMOSPHERE, MAGNETOSPHERE AND PLASMAS IN SPACE (AMPS). SPACELAB PAYLOAD DEFINITION STUDY. VOLUME 3, BOOK 2: AMPS EQUIPMENT TO SPACELAB ICD Final Report

Nov. 1976 22 p 8 Vol.
(Contract NAS8-31690)
(NASA-CR-152567; TRW-27615-6007-RU-02-Vol-3) Avail: NTIS HC A02/MF A01 CSCL 22A

The interfaces between AMPS Payload No.(TBD) and Spacelab are described. The interfaces specified cover the AMPS physical, electrical, and thermal interfaces that are established to prescribe the standard Spacelab configuration required to perform the mission. If the configuration definition changes due to change of Spacelab equipment model, or serial numbers, then reidentification of the Labcraft payload may be required. Author

N77-28171*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

ATMOSPHERE, MAGNETOSPHERE AND PLASMAS IN SPACE (AMPS). SPACELAB PAYLOAD DEFINITION STUDY. VOLUME 3, BOOK 3: AMPS EQUIPMENT TO INSTRUMENTS (VECTOR MAGNETOMETER) ICD Final Report

Nov. 1976 11 p 8 Vol.
(Contract NAS8-31690)
(NASA-CR-152568; TRW-27615-6007-RU-03-Vol-3) Avail: NTIS HC A02/MF A01 CSCL 22A

The electrical, mechanical, and environmental interfaces between the boom-mounted flux gate magnetometer and the AMPS/Spacelab are described. Author

N77-28172*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

ATMOSPHERE, MAGNETOSPHERE AND PLASMAS IN SPACE (AMPS). SPACELAB PAYLOAD DEFINITION STUDY. VOLUME 4, BOOK 1: LABCRAFT PAYLOAD GENERAL SPECIFICATION Final Report

Nov. 1976 50 p
(Contract NAS8-31690)
(NASA-CR-152569; TRW-27615-6007-RU-04-Vol-4) Avail: NTIS HC A03/MF A01 CSCL 22A

The performance, design, verification and operational requirements for Labcraft equipment and Labcraft integrated payloads are described. The requirements are based on the current definition of Spacelab and Space Transportation System equipment and the constraints associated with their use. Author

N77-28173*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

ATMOSPHERE, MAGNETOSPHERE AND PLASMAS IN SPACE (AMPS). SPACELAB PAYLOAD DEFINITION STUDY. VOLUME 4, BOOK 2: LABCRAFT INSTRUMENT SYSTEMS GENERAL SPECIFICATION Final Report

Nov. 1976 57 p 8 Vol.
(Contract NAS8-31690)
(NASA-CR-152570; TRW-27615-6007-RU-05-Vol-4) Avail: NTIS HC A04/MF A01 CSCL 22A

The interfaces between the scientific instruments and the Spacelab/Labcraft equipment are described. The characteristics of the Spacelab/Labcraft equipment pertinent to the scientific instruments and the requirements placed on the scientific instruments by the Spacelab/Labcraft equipment are described. Author

N77-28174*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

ATMOSPHERE, MAGNETOSPHERE AND PLASMAS IN SPACE (AMPS). SPACELAB PAYLOAD DEFINITION STUDY. VOLUME 5: TECHNICAL SUMMARY Final Report

Nov. 1976 309 p 8 Vol.
(Contract NAS8-31690)
(NASA-CR-152571; TRW-27615-6007-RE-06-Vol-5) Avail: NTIS HC A14/MF A01 CSCL 22A

Engineering and operational facets associated with the implementation of the first two AMPS flights are covered. The payload is described including all systems and subsystems and the mission planning and flight operations are described too. Payload integration, ground operations, and logistics are included along with key supporting analyses and mass properties. Author

N77-28175*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

ATMOSPHERE, MAGNETOSPHERE AND PLASMAS IN SPACE (AMPS). SPACELAB PAYLOAD DEFINITION STUDY. VOLUME 7, BOOK 2: AMPS PHASE C/D ANALYSIS AND PLANNING DOCUMENT Final Report

Nov. 1976 156 p 8 Vol.
(Contract NAS8-31690)
(NASA-CR-152572; TRW-27615-6007-RU-08-Vol-7) Avail: NTIS A08/MF A01 CSCL 22A

The results are presented of the AMPS Phase C/D (Design, Development, and Operations) program analysis and planning effort. Cost and schedule estimates are included. Although the AMPS program has been specifically addressed, these task descriptions are basically adaptable to a broader-based program incorporating additional or different Spacelab/orbiter payloads. Author

N77-28176*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

ATMOSPHERE, MAGNETOSPHERE AND PLASMAS IN SPACE (AMPS). SPACELAB PAYLOAD DEFINITION STUDY. VOLUME 7, BOOK 3: SUPPORTING RESEARCH AND TECHNOLOGY (SR AND T) REPORT Final Report

Nov. 1976 10 p 8 Vol.
(Contract NAS8-31690)
(NASA-CR-152573; TRW-27615-6007-RU-09-Vol-7) Avail: NTIS HC A02/MF A01 CSCL 22A

The items indentified as required to support the AMPS mission and requiring SR and T support and further work are: (1) a general purpose Experiment Pointing Mount; (2) a technique for

measuring the attitude of the pallet-mounted or deployed experiments; (3) the development of a common optics cryogenically cooled interferometer spectrometer; (4) the development of a differential absorption lidar system for the measurement of ozone densitites in the earth's atmosphere; (5) the development of dc to dc power processors which are capable of converting energy stored in a capacitor system at 500 V to energy supplied to equipment operating at 40 kV and at 20 kW (eventually up to 100 kW); and (6) the development of a magnetic or possibly electrostatic deflection system capable of bending the beam of an electron accelerator. A data sheet is included for each item, briefly describing the background and need for each item, and the general objectives of the required development, and identifying the schedule requirements in support of the AMPS program.
Author

N77-28177# Defense Systems Management School, Fort Belvoir, Va.
OPERATIONS MANAGEMENT OF DOD SPACE MISSIONS IN THE SHUTTLE ERA
Charles A. Tringali Nov. 1976 106 p refs
(AD-A038673) Avail: NTIS HC A06/MF A01 CSCL 22/2

This report presents a history of the development of the Space Transportation System (STS) to date between the National Aeronautics and Space Administration (NASA) and the executive agency acting for the Department of Defense, the United States Air Force. The STS consists of the NASA-developed space shuttle orbiter, the USAF-developed upper stage, the communications networks and launch base complexes of both agencies, and the satellite payloads developed by many user agencies to be placed in space. The program development is traced chronologically in terms of key joint-agency agreements, management interfaces, and compromises made as implementation of early proposals was accomplished. A proposal is made to develop a joint-agency STS operation authority responsive to national command/policy channels.
Author (GRA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N77-28178*# National Aeronautics and Space Administration, Washington, D. C.
SATELLITES FOR DISTRESS ALERTING AND LOCATING: REPORT BY INTERAGENCY COMMITTEE FOR SEARCH AND RESCUE AD HOC WORKING GROUP Final Report
Eugene Ehrlich Oct. 1976 178 p refs Sponsored by NASA, US Coast Guard, FAA, FCC, USAF, Aircraft Owners and Pilots Assoc., and Natl. Assoc. for Search and Rescue
(NASA-TM-74770) Avail: NTIS HC A09/MF A01 CSCL 17B

The background behind the congressional legislation that led to the requirement for the Emergency Locator Transmitter (ELT) and the Emergency Position-Indicating Radio Beacon (EPIRB) to be installed on certain types of aircraft and inspected marine vessels respectively is discussed. The DAL problem is discussed for existing ELT and EPIRB equipped aircraft and ships. It is recognized that the DAL requirement for CONUS and Alaska and the maritime regions are not identical. In order to address the serious DAL problem which currently exists in CONUS and Alaska, a low orbiting satellite system evolves as the most viable and cost effective alternative that satisfies the overall SAR system design requirements. A satellite system designed to meet the needs of the maritime regions could be either low orbiting or geostationary. The conclusions drawn from this report support the recommendation to proceed with the implementation of a SAR orbiting satellite system.
Author

N77-28179# Swedish Space Corp., Solna.
STUDY OF THE PROPOSED SOUNDING ROCKET PROJECT BA-GEOS
18 Feb. 1977 59 p refs
(S2-18) Avail: NTIS HC A04/MF A01 CSCL 22A

Ba-GEOS was proposed at the ESTEC meeting about collaborative sounding rocket projects on September 15-17, 1976. The project aims at two rocket launchings from Esrange in coordination with GEOS around the autumn equinox 1978. The rockets will be launched to about 400 km, each carrying a barium ion jet experiment in a daughter payload and an instrumented mother payload. Groups from France, Germany, Norway, Sweden and U.S.A. have proposed the on-board experiments.
Author

N77-28180*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AILERON ROLL HYSTERESIS EFFECTS ON ENTRY OF SPACE SHUTTLE ORBITER
Richard W. Powell Washington Jul. 1977 49 p refs
(NASA-TN-D-8425; L-11010) Avail: NTIS HC A03/MF A01 CSCL 22B

Six-degree-of-freedom simulations of the space shuttle orbiter entry with control hysteresis were conducted on the NASA Langley Research Center interactive simulator known as the automatic reentry flight dynamics simulator. These simulations revealed that the vehicle can tolerate control hysteresis producing a + or - 50 percent change in the nominal aileron roll characteristics and an offset in the nominal characteristics equivalent to a + or - 5 deg aileron deflection with little increase in the reaction control system's fuel consumption.
Author

N77-28181*# General Electric Co., Hampton, Va. Viking Project Support Services.
A COMPILATION OF SPACECRAFT LOADS DATA FROM FOUR TITAN CENTAUR LAUNCH VEHICLE FLIGHTS. VOLUME 1: ACOUSTICS DATA
George Kachadourian, comp. Jan. 1977 127 p ref 5 Vol. (Contract NAS1-9100)
(NASA-CR-144944) Avail: NTIS HC A07/MF A01 CSCL 22B

The payloads carried by the first four Titan Centaur launch vehicle flights were, a Viking spacecraft dynamic simulator, the Helios A spacecraft, and the two Viking spacecraft. Dynamic loads data were accumulated from these four flights for application to the Viking spacecraft. The accoustics data include time histories and spectral analysis plots of accoustic pressure measurements made in the Centaur and payload compartment during launch flight. Summary plots are presented to show composite spectra for liftoff and Mach 1/Max Q periods of flight.
Author

N77-28182*# General Electric Co., Hampton, Va. Viking Project Support Services.
A COMPILATION OF SPACECRAFT LOADS DATA FROM FOUR TITAN CENTAUR LAUNCH VEHICLE FLIGHTS. VOLUME 2, PART 1: VIBRATION POWER SPECTRAL DENSITY ANALYSIS OF LAUNCH AND MAX Q FLIGHT

George Kachadourian, comp. Jan. 1977 77 p
(Contract NAS1-9100)
(NASA-CR-144945-Pt-1) Avail: NTIS HC A05/MF A01 CSCL 22B

Summary plots are presented for the time histories and power spectral density analyses of vibration and acceleration on the spacecraft from the Titan Centaur launchings carrying the Viking dynamic simulator and the two Viking spacecraft (TC-1, TC-3 and TC-4). Author

N77-28183*# General Electric Co., Hampton, Va. Viking Project Support Services.
A COMPILATION OF SPACECRAFT LOADS DATA FROM FOUR TITAN CENTAUR LAUNCH VEHICLE FLIGHTS. VOLUME 2, PART 2: VIBRATION POWER SPECTRAL DENSITY ANALYSIS OF LAUNCH AND MAX Q FLIGHT
George Kachadourian, comp. Jan. 1977 175 p
(Contract NAS1-9100)
(NASA-CR-144945-Pt-2) Avail: NTIS HC A08/MF A01 CSCL 22B

Power spectral density plots and associated time history plots are presented for the Titan-Centaur launch carrying the Viking dynamic simulator. D.M.L.

N77-28184*# General Electric Co., Hampton, Va. Viking Project Support Services.
A COMPILATION OF SPACECRAFT LOADS DATA FROM FOUR TITAN CENTAUR LAUNCH VEHICLE FLIGHTS. VOLUME 2, PART 3: VIBRATION POWER SPECTRAL DENSITY ANALYSIS OF LAUNCH AND MAX Q FLIGHT
George Kachadourian, comp. Jan. 1977 125 p
(Contract NAS1-9100)
(NASA-CR-144945-Pt-3) Avail: NTIS HC A06/MF A01 CSCL 22B

Power spectral density plots and associated time history plots are presented for the Titan-Centaur launch carrying the Viking A spacecraft. D.M.L.

N77-28185*# General Electric Co., Hampton, Va. Viking Project Support Service.
A COMPILATION OF SPACECRAFT LOADS DATA FROM FOUR TITAN CENTAUR LAUNCH VEHICLE FLIGHTS. VOLUME 2, PART 4: VIBRATION POWER SPECTRAL DENSITY ANALYSIS OF LAUNCH AND MAX Q FLIGHT
George Kachadourian, comp. Jan. 1977 167 p
(Contract NAS1-9100)
(NASA-CR-144945-Pt-4) Avail: NTIS HC A08/MF A01 CSCL 22B

Power spectral density plots and associated time history plots are presented for the Titan-Centaur launch carrying the Viking B spacecraft. D.M.L.

N77-28186*# General Electric Co., Hampton, Va. Viking Project Support Services.
A COMPILATION OF SPACECRAFT LOADS DATA FROM FOUR TITAN CENTAUR LAUNCH VEHICLE FLIGHTS. VOLUME 3, PART 1: SHOCK SPECTRA OF TRANSIENTS
George Kachadourian, comp. Jan. 1977 55 p refs 5 Vol.
(Contract NAS1-9100)
(NASA-CR-144946-Pt-1) Avail: NTIS HC A04/MF A01 CSCL 22B

Time histories and shock-spectra of vibration and acceleration were obtained during the TC-1, TC-4 and TC-3 launch and staging events. Summary plots are presented and comparisons to Viking Program midfrequency sine test requirements are made. Author

N77-28187*# General Electric Co., Hampton, Va. Viking Project Support Services.
A COMPILATION OF SPACECRAFT LOADS DATA FROM FOUR TITAN CENTAUR LAUNCH VEHICLE FLIGHTS. VOLUME 3, PART 2: SHOCK SPECTRA OF TRANSIENTS
George Kachadourian, comp. and Henry T. Thorton, Jr. Jan. 1977 125 p Prepared in cooperation with NASA. Langley 5 Vol.
(Contract NAS1-9100)
(NASA-CR-144946-Pt-2) Avail: NTIS HC A06/MF A01 CSCL 22B

Shock spectra are presented for the TC-1 (Viking dynamic simulator) flight. D.M.L.

N77-28188*# General Electric Co., Hampton, Va. Viking Project Support Services.
A COMPILATION OF SPACECRAFT LOADS DATA FROM FOUR TITAN CENTAUR LAUNCH VEHICLE FLIGHTS. VOLUME 3, PART 3: SHOCK SPECTRA OF TRANSIENTS
George Kachadourian, comp. Jan. 1977 126 p 5 Vol.
(Contract NAS1-9100)
(NASA-CR-144946-Pt-3) Avail: NTIS HC A07/MF A01 CSCL 22B

Shock spectra are presented for the TC-4 (Viking A Spacecraft) flight. D.M.L.

N77-28189*# General Electric Co., Hampton, Va. Viking Project Support Services.
A COMPILATION OF SPACECRAFT LOADS DATA FROM FOUR TITAN CENTAUR LAUNCH VEHICLE FLIGHTS. VOLUME 3, PART 4: SHOCK SPECTRA OF TRANSIENTS
George Kachadourian, comp. Jan. 1977 215 p 5 Vol.
(Contract NAS1-9100)
(NASA-CR-144946-Pt-4) Avail: NTIS HC A10/MF A01 CSCL 22B

Shock spectra are presented for the TC-3 (Viking B Spacecraft) flight. D.M.L.

N77-28190*# General Electric Co., Hampton, Va. Viking Program Support Services.
A COMPILATION OF SPACECRAFT LOADS DATA FROM FOUR TITAN CENTAUR LAUNCH VEHICLE FLIGHTS. VOLUME 4, PART 1: TITAN STAGE 1 AND CENTAUR FIRST BURN OSCILLATIONS
George Kachadourian, comp. Jan. 1977 45 p 5 Vol.
(Contract NAS1-9100)
(NASA-CR-144947-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 22B

Time history and PSD data are presented showing the character of the first longitudinal mode oscillation which occurred during the Centaur first burn of the TC-4 and TC-3 flights. Author

N77-28191*# General Electric Co., Hampton, Va. Viking Project Support Services.
A COMPILATION OF SPACECRAFT LOADS DATA FROM FOUR TITAN CENTAUR LAUNCH VEHICLE FLIGHTS. VOLUME 4, PART 2: TITAN STAGE 1 AND CENTAUR FIRST BURN OSCILLATIONS
George Kachadourian, comp. Jan. 1977 114 p 5 Vol.
(Contract NAS1-9100)
(NASA-CR-144947-Pt-2) Avail: NTIS HC A06/MF A01 CSCL 22B

Power spectral density plots of vibration and strain data are presented for the Titan stage 1 burn and the Centaur main engine first burn of the TC-4 flight (Viking A spacecraft) D.M.L.

N77-28192*# General Electric Co., Hampton, Va. Viking Project Support Services.
A COMPILATION OF SPACECRAFT LOADS DATA FROM FOUR TITAN CENTAUR LAUNCH VEHICLE FLIGHTS. VOLUME 4, PART 3: TITAN STAGE 1 AND CENTAUR FIRST BURN OSCILLATIONS
George Kachadourian, comp. Jan. 1977 131 p 5 Vol.
(Contract NAS1-9100)
(NASA-CR-144947-Pt-3) Avail: NTIS HC A07/MF A01 CSCL 22B

Power spectral density plots of vibration and strain data are presented for the Titan stage 1 burn and the Centaur main engine first burn of the TC-3 flight (Viking B spacecraft). D.M.L.

N77-28193*# General Electric Co., Hampton, Va. Viking Project Support Services.
A COMPILATION OF SPACECRAFT LOADS DATA FROM FOUR TITAN CENTAUR LAUNCH VEHICLE FLIGHTS. VOLUME 5, PART 1: TIME HISTORY PLOTS
George Kachadourian, Comp. Jan. 1977 41 p
(Contract NAS1-9100)
(NASA-CR-144948-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 22B

Extended time history plots are presented for the TC-1, TC-3, and TC-4 flights. Vibration, strain, acceleration, force, and moment data are included. D.M.L.

N77-28194*# General Electric Co., Hampton, Va. Viking Project Support Services.
A COMPILATION OF SPACECRAFT LOADS DATA FROM FOUR TITAN CENTAUR LAUNCH VEHICLE FLIGHTS. VOLUME 5, PART 2: TIME HISTORY PLOTS
George Kachadourian, Comp. Jan. 1977 70 p
(Contract NAS1-9100)
(NASA-CR-144948-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 22B
For abstract, see N77-28193.

N77-28195*# General Electric Co., Hampton, Va. Viking Project Support Services.
A COMPILATION OF SPACECRAFT LOADS DATA FROM FOUR TITAN CENTAUR LAUNCH VEHICLE FLIGHTS. VOLUME 5, PART 3: TIME HISTORY PLOTS
George Kachadourian, Comp. Jan. 1977 87 p
(Contract NAS1-9100)
(NASA-CR-144948-Pt-3) Avail: NTIS HC A05/MF A01 CSCL 22B
For abstract, see N77-28193.

N77-28196# RAND Corp., Santa Monica, Calif.
USER'S MANUAL FOR RTRAJ: A TRAJECTORY ESTIMATION AND SIMULATION PROGRAM Interim Report
R. H. Frick Feb. 1977 86 p ref
(Contract F49620-77-C-0023)
(AD-A038478; R-1903-AF) Avail: NTIS HC A05/MF A01 CSCL 09/2
Operating instructions for a computer program designed to provide a best estimate of the accuracy with which the motion of a vehicle can be determined on the basis of either inertial guidance measurements or external tracking, or both are presented. The performance of the moving vehicle is described by the estimated deviation from its nominal performance. The program, developed by and used at Rand, should prove useful in the fields of ballistic missile accuracy, range instrumentation, and navigational satellites. Author (GRA)

N77-28197# Naval Surface Weapons Center, Dahlgren, Va. Dept. of Warfare Analysis.
OCEAN TIDES IN THE EQUATIONS OF MOTION OF THE TERRA SYSTEM OF COMPUTER PROGRAMS FOR SATELLITE GEODESY Final Report
W. Groeger and R. Manrique Dec. 1976 41 p refs
(AD-A038291; NSWC/DL-TR-3535) Avail: NTIS HC A03/MF A01 CSCL 08/3
An algorithm is specified for the Newtonian attraction which the ocean tide exerts on artificial satellites of the earth. Only the semidiurnal lunar tide is presently considered. But, it is indicated how various other spectral components of the fluid tide may be accounted for, if desired. The algorithm starts from a table for the global tide amplitudes and phase angles. It proceeds by approximating the gravitational potential exterior to the earth, caused by the tidal bulge, by that of a system of point masses on the ocean surface. For the sake of flexibility, separate computational schemes are described for the potential and the perturbing acceleration, the former being independent of the latter. This is to facilitate investigations which may eventually be conducted, such as studies of the shape of the tidal bulge. Author (GRA)

N77-28198# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Aeroballistics Directorate.
AN INVESTIGATION OF STREAMWISE BODY-FIN GAPS AS A MEANS OF ALLEVIATING THE ADVERSE PLUME EFFECTS ON MISSILE LONGITUDINAL STABILITY
James H. Henderson Jan. 1977 91 p refs
(DA Proj. 1W63-62303-A-214)
(AD-A038551; RD-77-13) Avail: NTIS HC A05/MF A01 CSCL 16/4
Transonic wind tunnel tests were conducted on a body of revolution with various fin configurations to investigate jet plume effects on missile longitudinal stability. The sting-mounted model utilized a series of cold air normal jets located downstream of the base to simulate the jet plume. Fins of various planform geometry were tested in three longitudinal positions. Present report compares one fin planform with and without a 5 percent body diameter gap. Gap results in a small reduction of adverse plume effects for fins in aft position. Data for this investigation were obtained from Calspan test CAL T17-123. Author (GRA)

N77-28199# Watervliet Arsenal, N.Y.
QUALITATIVE STABILITY CHARACTERISTICS OF A FLEXIBLE MISSILE SUBJECTED TO A CIRCULATORY THRUST
G. L. Anderson Feb. 1977 32 p refs
(AD-A038729; WVT-TR-77007) Avail: NTIS HC A03/MF A01 CSCL 16/4
The stability characteristics of an elastic, flexible missile of constant mass, modeled mathematically as a system consisting of three rigid bars elastically hinged at the joints and subjected to a constant circulatory thrust, are examined. Plots of eigencurves are presented and used to identify the regions of stability, divergence, and flutter in related stability maps. For anti-tangential and sub-tangential thrusts, the system is found to be divergent for any sufficiently small, positive thrust. Moreover, flutter does not occur for anti-tangential and super-tangential thrusts. Author (GRA)

N77-28200# Defense Systems Management School, Fort Belvoir, Va.
MAJOR RANGE ACQUISITIONS FOR THE SPACE SHUTTLE/SATELLITE CONTROL SATELLITE ERA
Robert E. Lauck Nov. 1976 38 p refs
(AD-A038670) Avail: NTIS HC A03/MF A01 CSCL 22/2
The 1980's will see a new era in military space activities. The Space Shuttle and Satellite Control Satellite are two systems which will expedite a transition from a research and development orientation to operational exploitation of this fourth medium. The USAF National Ranges (Eastern Test Range, Western Test Range and Satellite Control Facility) will experience extensive changes in their missions and configuration with the advent of these systems. This study examines the directives and regulations governing the planning, programming and budgeting system (PPBS) for these Ranges. A review of potential changes to the Ranges to fully exploit the Shuttle and SCS capabilities is then accomplished. Capabilities which improve the effectiveness of space operations are analyzed, as well as, cost-saving and security improvements. It is concluded that major changes to Range configurations can be expected as a result of the employment of the Shuttle and SCS systems. An assessment of the effectiveness of the PPBS guidance to stimulate the necessary actions to accomplish these changes follows, with the conclusion that the Test and Evaluation (T and E) orientation of these directives and regulations does not provide the best environment for proper Range planning as we approach this new era in space operations. Recommendations include: revision of documentation to reflect the expanding operations roles of the Ranges; organizational changes at OSD and HQS AFSC levels; and establishment of an SCS program office within the Satellite Control Facility. Author (GRA)

N77-28201# Radiation Research Associates, Inc., Fort Worth, Tex.
CALCULATIONAL METHODS FOR PREDICTING THERMAL RADIATION SIGNALS AT SATELLITES
Ronald B. Livesay 6 May 1977 31 p refs Presented at the Ann. Satellite Diagn. Working Group Meeting, Patrick AFB, Fla., 8-10 Feb. 1977
(Contract F08606-77-C-0008)
(AD-A039544; RRA-M7702; AFTAC-TR-77-15) Avail: NTIS HC A03/MF A01 CSCL 04/1
This report describes the calculational methods developed to predict thermal radiation signals at satellite-borne detector systems resulting from radiation emitted by point isotropic thermal radiation sources positioned within the atmosphere. The time-dependent atmospheric transport data currently available from POLO Monte Carlo calculations are described and the methods available for convoluting the time dependent atmospheric

transport data with the wavelength and time-dependent emission from thermal radiation sources are outlined. Author (GRA)

N77-28202# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
ANALYSIS OF HARPOON MISSILE STRUCTURAL RESPONSE TO AIRCRAFT LAUNCHES, LANDINGS, CAPTIVE FLIGHT AND GUNFIRE Final Report, May 1974 - Jan. 1976
Allan G. Piersol Jan. 1977 102 p refs
(Contract N60530-75-M-812C)
(AD-A036209; BBN-3159; NWC-TP-5880) Avail: NTIS HC A06/MF A02 CSCL 16/4

During its service life the HARPOON missile will be exposed to various types of shock and vibration loads which pose a reliability hazard to the missile and its equipment. This report discusses the response of the HARPOON missile to shock loads during catapult launches and arrested landings of the missile-carrying aircraft, long-term vibration during captive flight, and short-term vibration induced by aircraft gunfire. To evaluate the missile's response to these shock and vibration loads, a number of catapult launch and arrested landing tests were performed using an A-7E aircraft carrying an instrumented HARPOON missile; extensive captive flight vibration and surface pressure measurements were made for various flight conditions and carrying positions of the instrumented missile on A-7C, S-3A, and P-3C aircraft; and vibration caused by gunfire during the A-7C tests was measured. Although the primary purpose of this measurement program was to obtain HARPOON missile structural response data for comparison to the HARPOON environmental design criteria, also of interest was a comparison of the measured response levels to the test criteria of applicable specifications, as well as other available data for similar missiles. Author (GRA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N77-28203*# Aerospace Corp., El Segundo, Calif. Advanced Orbital Systems Div.
STS ANCILLARY EQUIPMENT STUDY. USER REFERENCE BOOK
James A. Plough Jun. 1977 175 p refs
(Contract NASw-2884)
(NASA-CR-153930; ATR-77(7373-02)-2) Avail: NTIS HC A08/MF A01 CSCL 22B

A record of what is currently known about STS ancillary equipment is presented in this user-oriented design so that a potential user may evaluate whether he could use the described ancillary equipment or if he would need to design and fabricate a payload-unique item. References that the user can use to obtain additional details and requirements to aid in his evaluation and decision are included. Author

N77-28204*# Hughes Aircraft Co., Culver City, Calif. Space and Communications Group.
EXPERIMENT DEFINITION PHASE SHUTTLE LABORATORY (LDRL-10.6 EXPERIMENT): SHUTTLE SORTIE TO ELLIPTICAL ORBIT SATELLITE Final Report
F. E. Goodwin, T. A. Nussmeier, L. S. Stokes, and E. J. Vourgourakis 15 Dec. 1976 206 p refs
(Contract NAS5-20018)
(NASA-CR-152488; D0824; SCG-60518R) Avail: NTIS HC A10/MF A01 CSCL 22A

The following topics were reviewed: (1) design options for shuttle terminal, (2) elliptical orbit satellite design options, (3) shuttle terminal details, (4) technology status and development requirements, (5) transmitter technology, and (6) carbon dioxide laser life studies. B.B.

N77-28205*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
LOAD CONTROL SYSTEM Final Report, Nov. 1975 - Jun. 1977
J. C. Grosse Jun. 1977 51 p Original contains color illustrations
(Contract NAS8-31669)
(NASA-CR-150352; MDC-G7038) Avail: NTIS HC A04/MF A01 CSCL 22B

The load control system developed for the shuttle external structural tests is described. The system consists of a load programming/display module, and a load control module along with the following hydraulic system components: servo valves, dump valves, hydraulic system components, and servo valve manifold blocks. One load programming/display subsystem can support multiple load control subsystem modules. Author

N77-28206*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A REAL-TIME DIGITAL COMPUTER PROGRAM FOR THE SIMULATION OF AUTOMATIC SPACECRAFT REENTRIES
Jack T. Kaylor, Lawrence F. Powell, and Richard W. Powell Washington Jul. 1977 132 p refs
(NASA-TM-X-3496; L-11260) Avail: NTIS HC A07/MF A01 CSCL 22C

The automatic reentry flight dynamics simulator, a nonlinear, six-degree-of-freedom simulation, digital computer program, has been developed. The program includes a rotating, oblate earth model for accurate navigation calculations and contains adjustable gains on the aerodynamic stability and control parameters. This program uses a real-time simulation system and is designed to examine entries of vehicles which have constant mass properties whose attitudes are controlled by both aerodynamic surfaces and reaction control thrusters, and which have automatic guidance and control systems. The program has been used to study the space shuttle orbiter entry. This report includes descriptions of the equations of motion used, the control and guidance schemes that were implemented, the program flow and operation, and the hardware involved. Author

N77-28768*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
LISP: PROGRAM IS DATA. A HISTORICAL PERSPECTIVE ON MACLISP
Jon L. White *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 181-189 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 09B

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N77-28207*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR THE MARINER VENUS/MERCURY 1973 PROJECT
E. K. Davis and M. R. Traxler 1 May 1977 430 p
(Contract NAS7-100)
(NASA-CR-154110; JPL-TM-33-797) Avail: NTIS HC A19/MF A01 CSCL 22D

The Tracking and Data System, which provided outstanding support to the Mariner Venus/Mercury 1973 project during the period from January 1970 through March 1975 are chronologically described. In the Tracking and Data System organizations, plans, processes, and technical configurations, which were developed and employed to facilitate achievement of mission objectives, are described. In the Deep Space Network position of the tracking and data system, a number of special actions were taken to greatly increase the scientific data return and to assist the project in coping with in-flight problems. The benefits of such actions were high; however, there was also a significant

increase in risk as a function of the experimental equipment and procedures required. Author

N77-28208# IBM Federal Systems Div., Huntsville, Ala.
SELF-CONTAINED, HIGH-ALTITUDE NAVIGATION SYSTEM STUDY: PRAIS NAVIGATION SYSTEM Final Report, 8 Dec. 1975 - 1 Jan. 1977
D. H. Aldrich, J. W. Simmons, and N. F. Toda Mar. 1977 33 p
(Contract F04701-76-C-0106)
(AD-A038488; IBM-77-D04-001S; SAMSO-TR-77-57-Vol-1)
Avail: NTIS HC A03/MF A01 CSCL 17/7

Circuits to add a passive ranging capability to the Interferometric Landmark Tracker (ILT) to form a Passive Range Interferometer Sensor (PRAIS) were built and tested in the laboratory. The laboratory test data were used in a Monte Carlo simulation to demonstrate the performance of the PRAIS Navigation System in a highly eliptical orbit and a synchronous (1 deg inclination) orbit. Navigation accuracies better than 1000 ft and attitude accuracy better than 10 arcsec were indicated by the analyses. Author (GRA)

N77-28209# IBM Federal Systems Div., Huntsville, Ala.
SELF-CONTAINED, HIGH-ALTITUDE NAVIGATION SYSTEM. VOLUME 2: SYSTEM TECHNICAL DESCRIPTION Final Report, 8 Dec. 1975 - 1 Jan. 1977
D. H. Aldrich, J. W. Simmons, and N. F. Toda Jan. 1977 88 p refs
(Contract F04701-76-C-0106)
(AD-A038489; IBM-77-D04-002S; SAMSO-TR-77-57-Vol-2)
Avail: NTIS HC A05/MF A01 CSCL 17/7

This report is Volume II of the three-volume final report on the Self-Contained High Altitude Navigation System (SCHANS) study. Volume I provides a summary description of the system concept, operation, performance, and configuration as well as a statement of application potential, conclusions, and recommendations. This volume describes results of SCHANS contract work by task. Volume III contains circuit level electrical design description of the Interferometric Landmark Tracker (ILT) Receiver and the Pulse Conversion Unit (PCU); it also contains an operational software Computer Program Development Specification. GRA

N77-28210# IBM Federal Systems Div., Huntsville, Ala.
SELF-CONTAINED, HIGH-ALTITUDE NAVIGATION SYSTEM STUDY: PRAIS NAVIGATION SYSTEM, VOLUME 3 Final Report, 8 Dec. 1975 - 1 Jan. 1977
R. E. Dreska, G. A. Kooch, and L. O. Smith Jan. 1977 260 p
(Contract F04701-76-C-0106)
(AD-A038490; IBM-77-D04-003S; SAMSO-TR-57-Vol-3) Avail: NTIS HC A12/MF A01 CSCL 17/7

This is volume III of a three-volume final report of the Self-Contained High Altitude Navigation System (SCHANS) study. Volume I consists of a system summary, and Volume II presents the results of the seven technical tasks of the contract. This Volume III consists of the following three appendices: Appendix A, Interferometric Landmark Tracker (ILT) Receiver Electrical Design Description, Appendix B, SCHANS Pulse Conversion Unit (PCU) Final Report, Appendix C, SCHANS Operational Software Computer Program Development Specification. GRA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N77-28211# Lockheed Missiles and Space Co., Palo Alto, Calif.
ELECTROMECHANICAL STABILIZATION SYSTEM
V. Leontev [1977] 3 p Transl. into ENGLISH from Aviatsiya i Kosmonavtika (USSR), no. 4, 1977 p 35
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Ill. 60616

Angular stabilization of space vehicles was examined. Rotation of an inertial mass, a flywheel is mentioned as an underlying operation principle and is discussed in detail. The principle of an electromechanical stabilization system is illustrated and analyzed. Results indicate that the application of an angular stabilization system distinguished by high utilizational qualities, reliability and accuracy of functioning during a long period with minimal energy expenditure, significantly increases the time of efficient utilization of space vehicles in orbit. B.B.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N77-28212*# Remtech, Inc., Huntsville, Ala.
TEST DATA FROM SMALL SOLID PROPELLANT ROCKET MOTOR PLUME MEASUREMENTS (FA-21)
Leroy M. Hair and Richard E. Somers Jun. 1976 294 p refs
(Contract NAS8-29751)
(NASA-CR-150348; RTR-016-4) Avail: NTIS HC A13/MF A01 CSCL 21H

A program is described for obtaining a reliable, parametric set of measurements in the exhaust plumes of solid propellant rocket motors. Plume measurements included pressures, temperatures, forces, heat transfer rates, particle sampling, and high-speed movies. Approximately 210,000 digital data points and 15,000 movie frames were acquired. Measurements were made at points in the plumes via rake-mounted probes, and on the surface of a large plate impinged by the exhaust plume. Parametric variations were made in pressure altitude, propellant aluminum loading, impinged plate incidence angle and distance from nozzle exit to plate or rake. Reliability was incorporated by continual use of repeat runs. The test setup of the various hardware items is described along with an account of test procedures. Test results and data accuracy are discussed. Format of the data presentation is detailed. Complete data are included in the appendix. Author

N77-28213*# Auburn Univ., Ala.
SOLID-PROPELLANT ROCKET MOTOR INTERNAL BALLISTIC PERFORMANCE VARIATION ANALYSIS, PHASE 2 Final Report
Richard H. Sforzini and Winfred A. Foster, Jr. Sep. 1976 127 p refs
(Contracts NCA8-00120; NCA8-00124)
(NASA-CR-150324) Avail: NTIS HC A07/MF A01 CSCL 21H

The Monte Carlo method was used to investigate thrust imbalance and its first time derivative throughtout the burning time of pairs of solid rocket motors firing in parallel. Results obtained compare favorably with Titan 3 C flight performance data. Statistical correlations of the thrust imbalance at various times with corresponding nominal trace slopes suggest several alternative methods of predicting thrust imbalance. The effect of

circular-perforated grain deformation on internal ballistics is discussed, and a modified design analysis computer program which permits such an evaluation is presented. Comparisons with SRM firings indicate that grain deformation may account for a portion of the so-called scale factor on burning rate between large motors and strand burners or small ballistic test motors. Thermoelastic effects on burning rate are also investigated. Burning surface temperature is calculated by coupling the solid phase energy equation containing a strain rate term with a model of gas phase combustion zone using the Zeldovich-Novozhilov technique. Comparisons of solutions with and without the strain rate term indicate a small but possibly significant effect of the thermoelastic coupling. Author

N77-28214*# Remtech, Inc., Huntsville, Ala.
TEST DATA FROM SOLID PROPELLANT PLUME AERODYNAMICS TEST PROGRAM IN AMES 6 X 6 FOOT SUPERSONIC WIND TUNNEL (SHUTTLE TEST FA7) (AMES TEST 033-66)
Leroy M. Hair Jan. 1975 254 p refs
(Contract NAS8-29751)
(NASA-CR-150346; RTR-016-2) Avail: NTIS HC A12/MF A01 CSCL 21H

The aerodynamic effects of plumes from hot combustion gases in the presence of a transonic external flow field were measured to advance plumes simulation technology, extend a previously acquired data base, and provide data to compare with the effects observed using cold gas plumes. A variety of underexpanded plumes issuing from the base of a strut-mounted ogive-cylinder body were produced by combusting solid propellant gas generators. The gas generator fired in a short-duration mode (200 to 300 msec). Propellants containing 16 percent and 2 percent A1 were used, with chamber pressures from 400 to 1800 psia. Conical nozzles of 15 deg half-angle were tested with area ratios of 4 and 8. Pressures were measured in the gas generator combustion chamber, along the nozzle wall, on the base, and along the body rear exterior. Schlieren photographs were taken for all tests. Test data are presented along with a description of the test setup and procedures. Author

N77-28215*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ROCKET MOTOR EXHAUST PRODUCTS GENERATED BY THE SPACE SHUTTLE VEHICLE DURING ITS LAUNCH PHASE (1976 DESIGN DATA)
J. M. Bowyer 1 Mar. 1977 72 p refs
(Contract NAS7-100)
(NASA-CR-154107; JPL-Publ-77-9) Avail: NTIS HC A04/MF A01 CSCL 21H

The principal chemical species emitted and/or entrained by the rocket motors of the space shuttle vehicle during the launch phase of its trajectory are considered. Results are presented for two extreme trajectories, both of which were calculated in 1976. Author

N77-28216*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTRICAL CHARACTERISTICS OF 2-OMEGA-cm 0.046-cm-THICK SILICON SOLAR CELLS AS A FUNCTION OF INTENSITY AND TEMPERATURE
P. A. Berman, T. F. Miyahara, and B. E. Anspaugh 1 Jul. 1977 38 p
(Contract NAS7-100)
(NASA-CR-154108; JPL-Publ-77-27) Avail: NTIS HC A03/MF A01 CSCL 10A

Electrical characteristics of Mariner '71 type of silicon solar cells are presented in graphical and tabular format as a function of intensity and temperature. Author

N77-28217*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SVDS PLUME IMPINGEMENT MODELING DEVELOPMENT. SENSITIVITY ANALYSIS SUPPORTING LEVEL B REQUIREMENTS
P. B. Chiu (McDonnell-Douglas Technical Services Co.), D. J. Pearson (McDonnell-Douglas Technical Services Co.), P. M. Muhm (McDonnell-Douglas Technical Services Co.), P. B. Schoonmaker (McDonnell-Douglas Technical Services Co.), and R. J. Radar (McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.) Jul. 1977 186 p refs
(NASA-TM-74768; JSC-12976; Rept-77-FM-38) Avail: NTIS HC A09/MF A01 CSCL 21H

A series of sensitivity analyses (trade studies) performed to select features and capabilities to be implemented in the plume impingement model is described. Sensitivity analyses were performed in study areas pertaining to geometry, flowfield, impingement, and dynamical effects. Recommendations based on these analyses are summarized. Author

N77-28218*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTEGRALLY REGULATED SOLAR ARRAY DEMONSTRATION USING AN INTEL 8080 MICROPROCESSOR
Edward J. Petrik Washington Jul. 1977 17 p refs
(NASA-TM-X-3566; E-9144) Avail: NTIS HC A02/MF A01 CSCL 10A

A concept for regulating the voltage of a solar array by using a microprocessor to effect discrete voltage changes was demonstrated. Eight shorting switches were employed to regulate a simulated array at set-point voltages between 10,000 and 15,000 volts. The demonstration showed that the microprocessor easily regulated the solar array output voltage independently of whether or not the switched cell groups were binary sized in voltage. In addition, the microprocessor provided logic memory capability to perform additional tasks such as locating and insolating a faulty switch. Author

N77-28219*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
LOW THRUST MONOPROPELLANT ENGINE Patent Application
John David Kuenzly, inventors (to NASA) (TRW, Redondo Beach, Calif.) Filed 25 Jul. 1977 13 p Sponsored by NASA
(NASA-Case-GSC-12194-1; US-Patent-Appl-SN-819029) Avail: NTIS HC A02/MF A01 CSCL 21H

A low thrust monopropellant engine is described having a conventional body and nozzle configuration wherein the monopropellant fuel is fed into the thruster with dual injection tubes via an injector shell with dual spray jets. The spray jets are positioned generally opposed to each other. A heater-screen pack combination thermally decomposes the fuel after injection into the combustion chamber of the thruster. NASA

N77-28220# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
EXPERIMENTS AND ANALYSIS RELATED TO EXTERNAL BURNING FOR PROPULSION Interim Report, Feb. 1976 - Jan. 1977
Douglas H. Neale, James E. Hubbartt, Warren C. Strahle, and Walter W. Wilson Mar. 1977 41 p refs
(Grant AF-AFOSR-2794-75; AF Proj. 2308)
(AD-A038874; AFOSR-77-0602TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

An experimental study of base flow for a 2.25 inch diameter projectile at Mach 3 with and without simulated external burning disturbances is reported. Base pressure and wake structure results from systematic variations in axisymmetric external compression show that substantial base thrust can be produced and that the pressure and length scales of the external compression are imposed on the near wake. Measurements with comparable axisymmetric and asymmetric compression contours show that peripherial gradients reduce the base pressure rise. Furthermore, relatively large changes in the near wake length scales and a slight reduction in the base pressure occur when the solid-blockage effects of discrete radial fuel jets are modeled with pegs mounted near the base of the test projectile. Author (GRA)

N77-28221# Air Force Office of Scientific Research, Washington, D.C.
JOINT 1977 AFOSR/AFRPL ROCKET PROPULSION RESEARCH MEETING Interim Report
Thomas C. Meier and Bernard T. Wolfson Mar. 1977 58 p Conf. proc. held at Lancaster, Calif., 7-11 Mar. 1977
(AF Proj. 2308)
(AD-A036352; AFOSR-77-0101TR) Avail: NTIS HC A04/MF A01 CSCL 21/8

This report contains abstracts from the 1977 Joint AFOSR/AFRPL Rocket Propulsion Research Meeting held 7-11 March

1977 at the Antelope Valley Inn, Lancaster, Ca. Presentations include research work sponsored by the two organizations as well as the work conducted in-house. Army and Navy combustion overviews are also contained as well as a Window-on-Science presentation from ONERA. Author (GRA)

N77-28222# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
PULSED BATES TESTING Final Report, Mar. - Jul. 1975
Jack E. Hewes and Jack J. Donn Apr. 1977 21 p refs
(AD-A039463; AFRPL-TR-77-16) Avail: NTIS HC A02/MF A01 CSCL 21/8

This experimental program was conducted to study the feasibility of pulsing a BATES motor and obtain combustion response data without interfering with motor performance measurement. The report details the testing performed using both piston and powder pulser and the resulting data. It was concluded that such testing is feasible and follow-on developments are planned. Author (GRA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N77-28223# Texas A&M Univ., College Station. Dept. of Chemistry.
UNUSUAL METALLOPORPHYRINS, PHOSPHORUS COMPLEXES OF TETRAPHENYLPORPHINE Interim Report
Carl J. Carrano and Minoru Tsutsui 1 Jan. 1977 16 p refs Submitted for publication
(Contract N00014-75-C-0417; NR Proj. 053-559)
(AD-A036681; TR-16) Avail: NTIS HC A02/MF A01 CSCL 07/4

The synthesis and spectral properties of several phosphorus complexes of tetraphenylporphine (TTP) are reported. The compounds appear to have the form (TPP)P(V)X(2+)Y(-) as previously reported by Gouterman et al. for the analogous octaethylporphyrin (OEP) complexes. The electronic and nmr spectra show a striking dependence on the nature of the anionic ligand X, which has not previously been reported and appears to be inconsistent with a symmetrical in-plane structure. Author (GRA)

N77-28224# Purdue Univ., Lafayette, Ind. Dept. of Electrical Engineering.
MATERIALS SCIENCES RESEARCH Final Report, 1 Jun. 1975 - 30 Sep. 1976
R. J. Schwartz 30 Sep. 1976 165 p refs
(Contract F44620-75-C-0090; ARPA Order 2982)
(AD-A036451; AFOSR-77-0095TR) Avail: NTIS HC A08/MF A01 CSCL 11/6

This final report covers work in three areas. In the area of modulated microstructures hardened steel, the final result was a sample which had a strength of 270 ksi and a fracture toughness of ksi sq. root(in). These properties were obtained with a 50% soft layer and a special 0.28%C alloy (Ni, Co, C, Mo, V). In the area of catalytic properties of surface sites, work is reported on the subjects of CO and NO reactions on chromia supported on silica, hydrocarbon synthesis over bimetallic clusters, characterization of surfaces by ESCA, and electrode reaction studies. The topic of imaging through the use of surface acoustic waves was addressed by considering three different types of devices: a separate media configuration employing high-resistivity silicon wafer and a lithium niobate substrate, a monolithic device employing the silicon and lithium niobate, and a separate media configuration where the silicon continuum is replaced by a pn diode array. In the course of research on the monolithic devices, a technique was developed for achieving a tremendous enhancement in photon detection sensitivity by using a pulsed bias supply. Author (GRA)

24 COMPOSITE MATERIALS

Includes laminates.

N77-28225* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SURFACE FINISHING Patent
Jack A. Kinzler, James T. Hefferman, Leroy G. Fehrenkamp, and William S. Lee, inventors (to NASA) Issued 28 Jun. 1977 8 p Filed 16 Apr. 1975 Supersedes N75-23476 (13 - 15, p 1752)
(NASA-Case-MSC-12631-1; US-Patent-4,032,089; US-Patent-Appl-SN-568541; US-Patent-Class-244-123; US-Patent-Class-428-141; US-Patent-Class-428-161; US-Patent-Class-428-425; US-Patent-Class-428-457; US-Patent-Class-428-458; US-Patent-Class-156-229) Avail: US Patent Office CSCL 11D

A surface of an article adapted for relative motion with a fluid environment is finished by coating the surface with a fluid adhesive. The adhesive is covered with a sheet of flexible film material under tension, and the adhesive is set while maintaining tension on the film material. Official Gazette of the U.S. Patent Office

N77-28226 California Univ., Los Angeles.
OPTIMUM DESIGN OF LAMINATED FIBER COMPOSITE PLATES Ph.D. Thesis
Mohammad Ali Tashkandi 1976 123 p
Avail: Univ. Microfilms Order No. 77-1669

The minimum weight optimum design of symmetric, balanced fiber composite laminates subject to distinct multiple loading conditions, each of which specifies inplane mechanical loads and uniform temperature changes, was investigated. The formulation included stiffness, strength, and elastic stability requirements as constraints. Three alternative strength criteria, namely: the maximum strain criterion, the Hill-Tsai criterion, and the stress interaction formulas were available. The optimization algorithm employed was based on the quadratic extended interior penalty function which led to a sequence of unconstrained minimization problems that can be solved by using a modified Newton method. Approximation concepts were used to improve overall computational efficiency. The approximations employed were: (1) design variable linking to preserve orthotropy, (2) temporary deletion of inactive constraints and (3) use of first order Taylor series expansions to generate explicit approximations for buckling load factors. Dissert. Abstr.

N77-28227 Purdue Univ., Lafayette, Ind.
A THEORETICAL AND EXPERIMENTAL STUDY OF STRENGTH AND ITS DISTRIBUTION IN FIBER-REINFORCED COMPOSITES Ph.D. Thesis
Shoji E. Yamada 1976 170 p
Avail: Univ. Microfilms Order No. 77-1803

This research is an attempt to develop a simple practical failure criterion for fiber-reinforced composite materials that can also account for the well known, statistical nature of the strength of composites. The theory was validated experimentally on glass-epoxy composites. The ultimate strengths of unidirectional fiber composites and three-layered cross-ply laminated composites subjected to an off-axis uniform tension were investigated. The strengths in the two principal directions and the in-plane shear strength were obtained experimentally as the bases of off-axis strength prediction. The experimental data were fit to the Weibull distribution, which seems quite satisfactory in describing the scatter of strength. The existing failure criteria were extended to incorporate the statistical behavior. The maximum work criterion together with the Monte Carlo method yielded good agreement with the experimental results. Dissert. Abstr.

N77-28228 Texas A&M Univ., College Station.
ON MICROCRACK GROWTH AND ARREST IN SIMULATED FIBROUS COMPOSITES Ph.D. Thesis
Nicholas Conrad 1976 112 p
Avail: Univ. Microfilms Order No. 77-2609

Opening, shearing and combined mode fracture tests were conducted with long rectangular strips of plexiglas clamped on the long edges and containing centered and off-centered cracks.

The critical stress intensity factors, crack initiation angles, and crack paths were evaluated. Fractured surfaces were then examined as to crack behavior. The maximum energy release rate criterion was extended to problems with a large degree of shearing mode present. This criterion was then used to predict the initial and subsequent crack propagation behavior presented in the experimental work. Crack arrest was examined for this rigid grip configuration. Using in part, information obtained from these studies, a flexible fiber model was investigated to determine the effect of fiber bending on crack behavior. Certain aspects of crack growth and arrest in these idealized fiber models were explored. Dissert. Abstr.

N77-28229*# Old Dominion Univ. Research Foundation, Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
RESULTS OF GRAPHITE-POLYIMIDE ISOGRID PANEL TESTING Interim Report
M. W. Hyer and Dale O. Douglas Jun. 1977 57 p refs
(Grant NsG-1167)
(NASA-CR-153935) Avail: NTIS HC A04/MF A01 CSCL 11D

A procedure was developed for fabricating short-fiber HTS graphite and NR150B2 polyimide resin into an isogrid configuration. After fabrication, the panels were subjected to structural analysis and testing. The testing program is described. Author

N77-28230# Forest Products Lab., Madison, Wis.
ECONOMIC FEASIBILITY OF PROCESS FOR HIGH-YIELD LAMINATED STRUCTURAL PRODUCTS
George B. Harpole (Lloyd W. Aubrey Engineering Co.) and Lloyd W. Aubrey 1977 26 p refs
(AD-A038923; FSRP-FPL-285) Avail: NTIS HC A03/MF A01 CSCL 11/12

Recovery of lumber-type products from sawlogs can be substantially greater than that by conventional sawing processes if veneer-product production methods are used. Economic analysis based on a hypothetical continuous-process veneer-product facility derives production costs of acceptable levels for producing high-strength and specialty lumber-type products. Continous laminating presses suitable for the facility evaluated are not yet commercially available but can be replaced with batch laminating presses for producing short-length products such as crossarms and railroad crossties. Methods may be developed to reduce glue costs. Increasing log prices will also increase the economic advantage of high-yield laminating processes. Author (GRA)

N77-28231# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
MECHANICAL BEHAVIOR OF FILAMENT-WOUND COMPOSITE TUBES
G. A. Wempner 14 Jan. 1977 20 p refs
(AD-A038421; RL-77-8) Avail: NTIS HC A02/MF A01 CSCL 16/1

The main component of a lightweight missile launcher is a cylindrical tube which is formed by a helical winding of glass filaments embedded in epoxy resin. In service, the tube is subjected to extreme internal pressure. Consequently, knowledge concerning the mechanisms of failure under pressure is vital to the analysis and design of these tubes. This report identifies the mechanisms of failure and offers appropriate methods to compute the ultimate pressure. Author (GRA)

N77-28232# Hercules, Inc., Magna, Utah. Bacchus Works.
GRAPHITE COMPOSITE AIRCRAFT LANDING GEAR WHEEL Final Report, 18 Mar. 1974 - 30 Oct. 1975
May 1976 91 p
(Contract F33615-74-C-3040)
(AD-A036207; AFFDL-TR-76-38) Avail: NTIS HC A05/MF A01 CSCL 01/3

The effort during Phase I of the contract included detailed design of a composite wheel assembly to function structurally and mechanically in a manner identical to the existing metal braked main landing gear wheel for the T-39 aircraft. The design and analysis of the graphite composite landing gear wheel was based on demonstrated material properties. A thermal analysis of the composite structure showed the maximum wheel temperature to be 406 F adjacent to the steel brake keys (inner wheel half) and 223 F on the outer wheel half. Hercules 4397/AS resin system was selected for the inner wheel half and 3501/AS for the outer half. During Phase II, one inner and two outer wheel halves were fabricated. Author (GRA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N77-28233 Purdue Univ., Lafayette, Ind.
THEORETICAL AND EXPERIMENTAL STUDIES IN FLASH PHOTOELECTROCHEMISTRY Ph.D. Thesis
Salvatore Sam Fratoni, Jr. 1976 306 p
Avail: Univ. Microfilms Order No. 77-1714

A theoretical model of the electrochemical cell, applicable to any electrolysis mechanism, was developed. This model was then used to characterize the effect of induced charging current (i.e., charging current caused by changing Faradaic current under applied potentiostatic conditions). The model was also extended to include potential-step chronoamperometry. Inability of blank measurements to correct for this effect led to inclusion of tabulated data that allow for direct extraction of Faradaic signals from total measured current. The theoretically predicted relationships were verified experimentally. The direct applicability of the model to correct experimental data and the magnitude of this correction are demonstrated. Dissert. Abstr.

N77-28234 Indiana Univ., Bloomington.
ELECTROCHEMISTRY OF ALKYL AND ACETYLENIC HALIDES Ph.D. Thesis
Gary Marshall McNamee 1976 93 p
Avail: Univ. Microfilms Order No. 77-1915

Cyclic voltammograms exhibit three distinct reduction waves. A cyclic voltammetric investigation of the benzylidenecycloalkanes formed by intramolecular cyclization of these phentyl-activated acetylenic bromides shows that the third voltammetric wave observed signals the reduction of the corresponding benzylidenecycloalkane. Benzylidenecyclobutane, the product of intramolecular cyclization of 5-bromo-1-phenyl-1-pentyne is more easily reduced than other benzylidenecycloalkanes and does not result in a separate wave in voltammograms for 5-bromo-1-phenyl-1-pentyne. Dissert. Abstr.

N77-28235 Indiana Univ., Bloomington.
INVESTIGATIONS OF ON-LINE COMPUTER CONTROL OF TITRIMETRIC AND SPECTROMETRIC ANALYTICAL INSTRUMENTATION Ph.D. Thesis
Terry Wayne Hunter 1976 165 p
Avail: Univ. Microfilms Order No. 77-2003

The performance of the hardwired titrator was evaluated and compared to a computer-controlled analog. Both the computer-controlled and hardwired systems were studied using strong acid-strong base, strong acid-weak base, and weak acid-strong base systems, with a glass indicating electrode. The computer-controlled system was also evaluated for redox and precipitation titrations. Relative standard deviations of 0.2% were observed with the computer-controlled system, while those obtained with the hardwired device were 0.4%. This difference in precision can be ascribed to the computer's ability to refine the collected data, and the inherent immunity from drift in derivative end point detection. Dissert. Abstr.

N77-28236 Indiana Univ., Bloomington.
TECHNIQUES OF AUTOMATIC BACKGROUND CORRECTION IN FLAME SPECTROCHEMICAL ANALYSIS Ph.D. Thesis
Robert J. Sydor 1976 184 p
Avail: Univ. Microfilms Order No. 77-2013

Instrumental approaches for automatic background correction were studied. Wavelength modulation, which requires rapid, repetitive scanning across the analyte line and an automatic

background-subtraction procedure which utilizes dual-channel monochromators were examined. Wavelength modulation was applied to a filter photometer which retained the advantages of a filter system and was also automatically corrected for background signals. The operating characteristics of this wavelength-modulated photometer were compared to those of a conventional dc photometer and found to be superior. The flame background emission signal from air-acetylene or nitrous oxide-acetylene flames was reduced to zero without the use of electronic zero suppression or a blank solution. The detected continuum emission signal resulting from a 1,000 microgram/ml potassium solution, acting as an ionization suppressant, was likewise greatly attenuated. The modulated flame photometer exhibited a detection limit for Ca of less than 10 ng/ml and a relative standard deviation of 0.4% at higher Ca concentrations. The practical utility of the apparatus is demonstrated with two real samples.
Dissert. Abstr.

N77-28237 Texas Univ., Austin.
COMBINED AUGER ELECTRON AND ULTRAVIOLET PHOTOELECTRON SPECTROSCOPY Ph.D. Thesis
David Britton Almy 1976 123 p
Avail: Univ. Microfilms Order No. 77-3856

A system was designed and constructed to investigate the structural and kinetic properties of adsorbed gases on surfaces. A double pass, retarding grid cylindrical mirror analyzer was used in conjunction with an electron gun to detect Auger electrons generated by irradiating the surface with photons from a helium gas discharge lamp. A quadrupole mass spectrometer was used to monitor the gas phase. This system was used to investigate single crystal sapphire (alpha-Al2O3) with its C axis oriented perpendicular to the surface plane. A polycrystalline palladium surface was also studied. These experiments indicate the possibility of making kinetic measurements on the palladium-catalyzed carbon monoxide oxidation reaction while directly monitoring surface valence states by means of ultraviolet photoelectron spectroscopy.
Dissert. Abstr.

N77-28238 North Carolina State Univ., Raleigh.
OPTICAL, NATURAL AND MAGNETIC CIRCULAR DICHROISM, AND MAGNETIC CIRCULAR LUMINESCENCE STUDIES Ph.D. Thesis
John David Gunter 1976 105 p
Avail: Univ. Microfilms Order No. 77-2748

A number of studies are presented in which the primary goal is the elucidation of electronic ground and excited state character. The series of tetrahalomercurate complexions, is studied using electronic absorption and magnetic circular dichroism (MCD) spectroscopies. Experimentally observed Faraday A terms of room temperature MCD spectra are found to be unauthentic on the basis of comparing 80 K electronic absorption spectra with MCD spectra. The bands are assigned as charge transfer excitations.
Dissert. Abstr.

N77-28239 Purdue Univ., Lafayette, Ind.
LASER RAMAN DIFFERENCE SPECTROSCOPY: INSTRUMENTATION, METHYLMERCURY (II) INTERACTIONS WITH THYMIDINE-5'-PHOSPHATE AND PRELIMINARY SPECTRA OF POLYNUCLEOTIDES Ph.D. Thesis
Ray Waldo Chrisman 1976 276 p
Avail: Univ. Microfilms Order No. 77-7431

A computer-controlled Raman difference spectrophotometer is described which allows four independent sample spectra to be accumulated with one scan of the monochromator. In addition to supporting the monochromator and sample changer stepping motors, the hardware supports a teletype, a high speed punch, a high speed reader, two strip chart recorders, a digital thermometer, a thermoelectric cooler and resistance heater, two 24-bit programmable counters, and a control panel which provides complete control of all functions of the instrument. The controller program for the instrument is described with copies of all programs included. The instrument was used to obtain spectra, which are presented, of the interaction of methylmercury (II) with TMP as a function of pH. Spectra of TMP as a function of pH are also presented. The first Raman difference spectra of dilute polynucleotides is presented.
Dissert. Abstr.

N77-28240 Stanford Univ., Calif.
QUANTITATIVE ELECTRON MICROSCOPY OF NUCLEIC ACIDS Ph.D. Thesis
Jill Ferguson 1976 156 p
Avail: Univ. Microfilms Order No. 77-7083

Techniques available for preparing nucleic acid samples for electron microscopy are reviewed. A quantitative approach to the electron microscopy of nucleic acids is emphasized and examples of quantitative applications of the techniques are discussed. A procedure for investigating the possibility of small amounts of partial DNA sequence homology between two defined DNA molecules is described and applied to test for sequence homology between simian virus 40 and polyoma DNAs. A method employing ferritin-conjugated antibody to visualize specific protein-DNA complexes in the electron microscope is demonstrated and used to the preferential binding od simian virus 40 T antigen at or near the origin of replication of simian virus 40 DNA. A technique for distinguishing DNA/DNA or RNA/DNA duplex regions from single strand regions of a DNA molecule in the electron microscope is also applied.
Dissert. Abstr.

N77-28241 Purdue Univ., Lafayette, Ind.
APPLICATION OF THE LABORATORY COMPUTER TO THE ACQUISITION, OPTIMIZATION, AND INTERPRETATION OF ELECTROCHEMICAL DATA Ph.D. Thesis
Quentin Vivian Thomas, Jr. 1976 184 p
Avail: NTIS Avail: Univ. Microfilms Order No. 77-7537

The laboratory computer was used to perform three important analytical functions: data acquisition, real-time optimization, and interpretation of complex electrochemical data. In each case, the computer was used to perform functions which would be either extremely tedious or very difficult to perform by conventional methods. Performance criteria were used to establish a minimum desirable instrumental response. The computerized analysis system then makes initial measurements of various experimental parameters and designs an experiment which will achieve the desired response. Provisions were made to allow for user interpretation and interaction at various stages of the analysis in order to augment the speed and efficiency of the computer with the experience and knowledge of the trained analyst.
Dissert. Abstr.

N77-28242 Illinois Univ., Urbana-Champaign.
COMPUTER ASSISTED STRUCTURAL INTERPRETATION OF FLUORESCENCE SPECTRA Ph.D. Thesis
Thomas Craig Miller 1976 197 p
Avail: Univ. Microfilms Order No. 77-9105

A computer file searching procedure for fluorescence spectra was developed. A comparison is made of the most obvious spectral features of the unknown to those of the reference compounds. These spectral features include the total number of peaks, peak locations, widths at half height, relative intensities, and the location of an excitation minimum. Both the fluorescence excitation and emission spectra are used in the comparison procedure. The fluorescence spectra for 1,000 reference compounds were used to establish the library file which is used by the file searching procedure. The library file was created by extracting the necessary spectral features from the reference spectra and then packing this information into 16-bit computer words. The entire 1,000 compound library can be stored in 6,600 computer words. During the comparisons, an index is calculated which numerically expresses the similarity between the unknown and the reference compound.
Dissert. Abstr.

N77-28243 Seton Hall Univ., South Orange, N. J.
A STUDY OF NONLINEAR EFFECTS USING INTERMODULATION POLAROGRAPHY Ph.D. Thesis
William Joseph Mergens 1976 155 p
Avail: Univ. Microfilms Order No. 77-7606

A comparison was made among the several theories describing second order polarographic behavior. Equations derived by Chiang, Smith, and Paynter are presented and discussed with respect to the present technique. The method is most appropriately classified as intermodulation polarography in which an amplitude modulated (AM) sine wave is employed as the excitation voltage. An instrument was constructed using both analog and digital electronics which is capable of monitoring intermodulation current, as well as the more conventional alternating and direct cell

currents. The excitation voltage for second order studies employed an AM wave synthesized by means of electronic multiplication of ac voltage at two frequencies. Dissert. Abstr.

N77-28244 Illinois Univ., Urbana-Champaign.
A STUDY OF SOME ENERGY SUFFICIENT ELECTROGENERATED CHEMILUMINESCENT REACTIONS Ph.D. Thesis
Paul Riley Michael 1976 156 p
Avail: Univ. Microfilms Order No. 77-9098

A study of electrogenerated chemiluminescence (ECL) was conducted by analyzing the shape of the luminescent decay curves resulting from a triple step reactant generation scheme. The ECL systems involved the reaction between the radical cation of thianthrene (TH) and the radical anion of 2,5-diphenyl-1,3,4-oxadiazole (PPD) and between the radical cation of tri-p-tolylamine (TPTA) and the anion radicals of benzophenone (BP) and 1,4-dicyanobenzene (DCB). These chemically stable, energy sufficient ECL systems were selected for study because they have the potential of being the simplest ECL reactions. Detailed investigations of their behavior were designed to provide a better foundation for interpretation of results from more complicated ECL systems. ECL decay curves were recorded by a minicomputer controlled data acquisition system. Dissert. Abstr.

N77-28245 Purdue Univ., Lafayette, Ind.
MASS-ANALYZED ION KINETIC ENERGY SPECTROMETRY AND SOME APPLICATIONS TO ANALYTIC CHEMISTRY Ph.D. Thesis
James Francis Litton 1976 219 p
Avail: Univ. Microfilms Order No. 77-7487

Mass-analyzed ion kinetic energy spectrometry (MIKES) was applied to a wide variety of problems, including studies of ion structures, thermochemistry of gaseous ions, and reaction mechanisms. The first of these applications is concerned with the use of two high energy ion/molecule reactions, collision-induced dissociation (CID) and charge stripping, in examining the structures of the stable C6H6(+) and C6H5(+) ions. The results show that there are at least two forms for the C6H6(+) ion which can be distinguished by charge stripping but not by CID. The second application involves the combination of the MIKES technique with chemical ionization and collision induced dissociation, and application of this method to molecular structure determination. Dissert. Abstr.

N77-28246 Purdue Univ., Lafayette, Ind.
NEW MASS SPECTROMETRIC METHODS AS ION STRUCTURE PROBES Ph.D. Thesis
David Lee Kemp 1976 181 p
Avail: Univ. Microfilms Order No. 77-7476

Three new types of mass spectra are investigated, and their applications to ion structure determinations and general chemical analysis are discussed. The linked scan method is a technique applicable to conventional double-focusing mass spectrometers in which the electric sector precedes the magnetic sector. The information obtained by this method is termed a simulated MIKE spectrum which is a record of all fragmentations which one selected ion undergoes in the first field free region of the instrument. A charge stripping mass spectrum is a new type of spectrum which yields information on the stability and structure of doubly-charged ions. These ions result from singly-charged ions produced in the source which then undergo a charge stripping reaction in the first field free region of a conventional double focusing mass spectrometer. Dissert. Abstr.

N77-28247# Lockheed Missiles and Space Co., Palo Alto, Calif.
PROBLEMS OF TECHNOLOGICAL COMBUSTION
A. G. Merzhanov 1977 28 p refs Transl. into ENGLISH from Protsessy goreniia v khimicheskoi tekhnologii i metallurgii, Chem. Phys. Inst. Akad. Nauk SSSR, chernogolovka, 1975 p 5-28
Avail: NTIS HC A03/MF A01; National Translation Center, John Crerar Library, Chicago, Ill. 60616

The fundamental combustion processes used to obtain useful materials (gaseous and condensed products of the chemical industry, metals and alloys, infusible inorganic compounds, etc.) are classified. The specific peculiarities of the combustion process as a chemicotechnological method are formulated, and certain problems of the development of this aspect are discussed. Author

N77-28248# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFLUENCE OF CAMPHOR ON THE REDUCTION KINETICS OF THE Zn(2+), Cd(2+), Eu(III) CATIONS
B. P. Afanasev and G. I. Avilova [1977] 6 p refs Transl. into ENGLISH from Elektrokhimiia (Moscow), v. 13, no. 3, 1977 p 356-360
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Ill. 60616

The kinetics of the electroreduction of Zn(+2), Cd(+2), and Eu(III) cations in the presence of camphor was investigated by a polarographic method. It was shown that the effect of the camphor differs qualitatively from the effect of surfactants, whose adsorption can be described within the framework of a generalized surface layer model. The half wave potentials for the reaction of electroreduction of the Zn(+2), Cd(+2), and Eu(III) cations agree with the values of the desorption potentials of camphor. Author

N77-28249*# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
COMBUSTION OF LIQUID SPRAYS AT HIGH PRESSURES Annual Report, 1976
A. J. Shearer and G. M. Faeth Mar. 1977 90 p refs
(Grant NGR-39-009-077)
(NASA-CR-135210) Avail: NTIS HC A05/MF A01 CSCL 21B

The combustion of pressure atomized fuel sprays in high pressure stagnant air was studied. Measurements were made of flame and spray boundaries at pressures in the range 0.1-9 MPa for methanol and n-pentane. At the higher test pressure levels, critical phenomena are important. The experiments are compared with theoretical predictions based on a locally homogeneous two-phase flow model. The theory correctly predicted the trends of the data, but underestimates flame and spray boundaries by 30-50 percent, indicating that slip is still important for the present experiments (Sauter mean diameters of 30 microns at atmospheric pressure under cold flow conditions). Since the sprays are shorter at high pressures, slip effects are still important even though the density ratio of the phases approach one another as the droplets heat up. The model indicates the presence of a region where condensed water is present within the spray and provides a convienient means of treating supercritical phenomena. Author

N77-28250# National Bureau of Standards, Washington, D. C.
HAZARD CHARACTERISTICS OF COMBUSTION PRODUCTS IN FIRES: THE STATE-OF-THE-ART REVIEW Final Report
Merritt M. Birky May 1977 48 p refs
(NASA Order C-97823-B)
(NASA-CR-135088; NBSIR-77-1234) Avail: NTIS HC A03/MF A01 CSCL 21B

The smoke inhalation hazard as related to human fatalities is reviewed, and the limitations of the fire fatality data and the methods that have been and are being used to assess the inhalation toxicity hazard are outlined. In depth autopsy studies of some of these fatalities show that carbon monoxide is the predominant toxicant produced from fires. Chemical analysis of combustion products has been used extensively to assess the toxicological hazard in fire research. The limitations of such measurements are addressed and a combination of toxicology (animal exposures) and analytical chemistry is recommended. The mechanism of toxic action of a few well known combustion products is discussed. Due to the extensive use of organophosphates as fire retardants in polymeric materials, the toxicity of this class of compounds is reviewed in some detail. Author

N77-28251*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CHEMICAL KINETIC MODELING OF PROPANE OXIDATION BEHIND SHOCK WAVES
Allen G. McLain and Casimir J. Jachimowski Washington Jul. 1977 32 p refs
(NASA-TN-D-8501; L-11606) Avail: NTIS HC A03/MF A01 CSCL 07D

The stoichiometric combustion of propane behind incident shock waves was studied experimentally and analytically over a temperature range from 1700 K to 2600 K and a pressure range from 1.2 to 1.9 atm. Measurements of the concentrations of carbon monoxide (CO) and carbon dioxide (CO2) and the product of the oxygen atom and carbon dioxide concentrations (O)(CO) were made after passage of the incident shock wave. A kinetic mechanism was developed which, when used in a computer program for a flowing, reacting gas behind an incident shock wave predicted experimentally measured results quite well. Ignition delay times from the literature were also predicted quite well. The kinetic mechanism consisted of 59 individual kinetic steps.
Author

N77-28252# Massachusetts Inst. of Tech., Cambridge.
THEORY OF CHEMICAL KINETICS Progress Report, 1 May 1976 - 30 Apr. 1977
John Ross Jan. 1977 12 p refs
(Contract EY-76-S-02-2873)
(COO-2873-1) Avail: NTIS HC A02/MF A01

Progress made on the theory of chemical reactions in a number of areas is described. Topics discussed include: (1) the analysis of details of chemical dynamics by the use of Franck-Condon factors; (2) stochastic reduction of collision dynamics; (3) interpretation of some experiments in laser-induced chemistry; (4) the study of a basis for orbital symmetry rules; and (5) cooperative instability phenomena in arrays of catalytic sites on which potentially unstable reaction mechanisms may occur. ERA

N77-28253# Naval Research Lab., Washington, D. C. Space Sciences Div.
THE BRAGG CRYSTAL SPECTROMETER AS A DIAGNOSTIC TOOL Interim Report
John F. Meekins 15 Feb. 1977 48 p refs
(AD-A037373; NRL-R-8063) Avail: NTIS HC A03/MF A01 CSCL 07/4

The Bragg crystal spectrometer, which consists of a diffraction crystal and a detector, is useful for diagnosing X-ray spectra. As with most instruments, its usefulness is limited by its characteristics or parameters. Crystal diffraction is treated theoretically here. Then a mathematical description of the interaction of the source, crystal, and detector is developed from a phenomenological viewpoint. Use of the Bragg crystal spectrometer as a diagnostic tool is discussed in terms of this description. Finally, methods for directly measuring Bragg crystal spectrometer characteristics are discussed and demonstrated with a lithium fluoride crystal as an example. Author (GRA)

N77-28254# General Electric Co., Santa Barbara, Calif.
REACTION RATE DATA, NUMBER 58; DNA REACTION RATE PROGRAM Annual Progress Report, FY 1976 and 7 T
Nov. 1976 28 p
(Contract DNA001-75-C-0023)
(AD-A038750) Avail: NTIS HC A03/MF A01 CSCL 07/2

Our DCHEM coupled reaction rate code was updated to include the latest data concerning chemical reactions and rate constants. Particular attention was given to the neutral chemistry involving hydrogen and to ion hydration reactions and also to ion-ion and electron-ion recombination rate constants. In addition, the code was revised and will now provide values of the 'effective rate constant' at any time desired. This will facilitate use of the code results in modeling efforts and in sensitivity calculations.
GRA

N77-28255# General Electric Co., Santa Barbara, Calif. DASIAC.
REACTION RATE DATA, NUMBER 57
Aug. 1976 24 p
(Contract DNA001-75-C-0023)
(AD-A038749) Avail: NTIS HC A02/MF A01 CSCL 07/2

This issue of the DASIAC Reaction Rate Data presents summaries of recent progress for investigations supported by the Defense Nuclear Agency in portions of its Reaction Rate Program, plus summaries of related work submitted by other, non-DNA-funded investigators.
GRA

N77-28256# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.
TEMPERATURE, CONCENTRATION VELOCITY AND TURBULENCE MEASUREMENTS IN JETS AND FLAMES Interim Report
S. Lederman, A. Celentano, and J. Glaser Dec. 1976 70 p refs Prepared by the Polytechnic Inst. of New York, Farmingdale
(Contract N00014-75-C-1143; NR Proj. 098-038; Proj. SQUID) (AD-A038423; SQUID-PIB-34-PU) Avail: NTIS HC A04/MF A01 CSCL 20/4

The recently developed Laser Raman, Laser Doppler Velocimetry and Coherent Antistokes Raman Scattering, are applied to the diagnostics of flow fields and flames. The concentration of species in a cold jet, and the velocities are measured and compared to measurements using standard techniques. The Raman and LDV techniques are then applied to diffusion flames. Experimental results concerning concentration of species, temperature, velocities, and turbulent intensities are obtained simultaneously. The latter are obtained from the LDV data as well as the concentration data. It is seen that by proper processing of the concentration data, an indication and a measure of the turbulent intensity may be obtained. It is further shown that from the simultaneously acquired concentration data, a parameter of major importance in turbulence modeling, the mixedness parameter, or the cross correlation function may be directly measured.
Author (GRA)

N77-28257# Army Materials and Mechanics Research Center, Watertown, Mass.
COMPOSITIONAL ANALYSIS OF HYDRAULIC FLUIDS USING LIQUID CHROMATOGRAPHY Final Report
Judith L. House and Gary L. Hagnauer Dec. 1976 16 p Presented at Hydraulic Fluids Meeting, NASA-Ames Research Center, 24-25 Feb. 1976
(AD-A038840) Avail: NTIS HC A02/MF A01 CSCL 11/8

The liquid exclusion mechanism for separation in liquid chromatography is evaluated for fingerprinting and monitoring the compositions of hydraulic fluids. A variety of hydraulic fluids are examined and testing procedures are developed. The utility of liquid chromatography in trace analysis and in separating specific fluid components for characterization or identification is demonstrated.
Author (GRA)

N77-28258# Picatinny Arsenal, Dover, N. J. Manufacturing Technology Directorate.
NEW CONTROL INSTRUMENTATION FOR MANUFACTURE OF ENERGETIC MATERIALS Interim Report
Michael Halik and Cleophus McIntosh Dec. 1976 65 p refs
(AD-A038284; PA-TM-2222) Avail: NTIS HC A04/MF A01 CSCL 19/1

Prototype process controls with fast detection, measurement, and feedback control capability have been developed by Picatinny Arsenal, Radford AAP, and selected contractors. These prototypes on-stream process analyzers will perform the function now being performed by various laboratory tests. The basic difference is in the method used for sampling, detection, measurement, and feedback. Sampling will be done on-stream wherever possible. Under these conditions, no sample retrieval is necessary. By utilizing the latest technological advances in physicochemical sensors and instrumentation, detection and measurement of the process control parameters can be accomplished in real time in most cases. Outputs from the detection and measuring instruments can be used to provide corrective action by means of automatic feedback.
Author (GRA)

N77-28259# National Bureau of Standards, Washington, D. C.
KERR COEFFICIENTS OF NITROBENZENE AND WATER Final Report
Robert E. Hebner, Jr., Richard J. Sojka, and Esther C. Cassidy Kirtland AFB, N. Mex. AFWL Nov. 1976 37 p refs Sponsored by AF
(AD-A036273; NBSIR-74-544; AFWL-TR-76-117) Avail: NTIS HC A03/MF A01 CSCL 07/4

The Kerr coefficients of both water and nitrobenzene were measured and the variation of these quantities with temperature and wavelength was investigated. At a temperature of 296 K and at a wavelength of 632.8 nm, the following values for the

Kerr coefficients were obtained B(C6H5NO2) = 3.24 x 10 to the -12th power m/V sq., and B(H2O) = 3.43 x 10 to the -14th power m/V sq. The estimated uncertainty in the measurement in nitrobenzene is + or - 6 percent while in water the estimated uncertainty is + or - 8 percent. The primary conclusion drawn is that although nitrobenzene can be used for accurate measurement of a wide, and fairly well defined, variety of high voltage pulses, the situation in water is more poorly understood. The primary areas of difficulty using water are the existence of turbulence under pulses of duration of a few microseconds and the possibility of a voltage dependence of the Kerr coefficient due to a saturation of the alignment of the molecules with the applied field. Author (GRA)

N77-28260# Chicago Univ., Ill. James Franck Inst.
HIGH TEMPERATURE THERMOCHEMISTRY OF INORGANIC MATERIALS
O. J. Kleppa 1977 7 p refs Repr. from Calorimetry and Thermal Analyses (Tokyo), 1976 p 15-23
(Grant DAHC04-74-G-0009)
(AD-A036445; ARO-11483.10-MC) Avail: NTIS HC A02/MF A01 CSCL 07/4

The high temperature thermochemistry of inorganic materials naturally falls into three principal but related areas of research: heat of mixing calorimetry, solution calorimetry, and reaction calorimetry of solids. A brief survey will be presented of the development of modern high temperature reaction calorimetry, and of its application in these areas. Emphasis will be placed on the author's work on oxide melt solution calorimetry and on reaction calorimetry of solids. Author (GRA)

N77-28261# Wright State Univ., Dayton, Ohio.
IN-SITU MEASUREMENTS OF GAS SPECIES CONCENTRATIONS IN SIMULATED DUMP COMBUSTOR FLOWFIELDS Final Technical Report, 23 Sep. 1975 - 30 Sep. 1976
C. Chang, G. D. Sides, and T. O. Tiernan Wright-Patterson AFB, Ohio AFAPL Nov. 1976 70 p refs
(Contract F33615-76-C-2010)
(AD-A036214; AFAPL-TR-76-105) Avail: NTIS HC A04/MF A01 CSCL 14/2

A sampling probe-mass spectrometer system was assembled, calibrated, and operated for making in-situ measurements of the concentrations of gaseous species in a combustor flow field. A series of tests were conducted in order to determine suitable design parameters for the gas inlet system and to determine the optimum operating conditions for the mass spectrometer. The accuracy of the mass spectrometric technique was verified over a wide range of concentrations through the analysis of gas mixtures with known compositions. In addition to the development of the gas sampling capability of the system constructed in the present research, this apparatus was interfaced to a computer in order to allow high-speed data acquisition and to facilitate data reduction. After the initial design and development phase, the mass spectrometric sampling system was used on a routine basis for the analysis of gas sampled from a simulated dump combustor flow field. Fuel (argon)/air mixing profiles were obtained for various test configurations and flow field conditions. The results of these tests illustrate the applicability of the gas sampling and analysis system to the in-situ measurement of gas species concentrations in high-pressure, ducted flow fields. Author (GRA)

N77-28262# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
PREDICTED VALUES OF THE VISCOSITY AND THERMAL CONDUCTIVITY COEFFICIENTS OF NITROUS OXIDE Final Technical Note
Howard J. M. Hanley Mar. 1977 68 p refs
(PB-266579/2; NBS-TN-673) Avail: NTIS HC A04/MF A01 CSCL 07D

The viscosity and thermal conductivity coefficients of nitrous oxide are calaculated for temperatures between 180 and 900K (330 to 1600R) for pressures to 23 MPa (approximately 3500 psi). Tables of values are presented. Two mixtures with carbon dioxide are also discussed. These transport coefficients (for the pure fluid and for the mixtures) were predicted from thermodynamic data. Details of the prediction procedure are presented. Estimates of the accuracy of the tabular values are + or - 6% for the viscosity and + or - 8% for the thermal conductivity. GRA

N77-28263# National Inst. for Occupational Safety and Health, Cincinnati, Ohio. Div. of Physical Engineering.
THE 2D NIOSH SOLID SORBENTS ROUNDTABLE
E. Vernon Ballou, ed. (San Jose State Univ., Calif.) Jul. 1976 243 p refs Conf. held at Cincinnati, 5-6 Dec. 1973
(PB-266449/8; DHEW/PUB/NIOSH-76/193; NIOSH-76/193) Avail: NTIS HC A11/MF A01 CSCL 07D

The primary interest of NIOSH in this area is the applicability of these solid materials to the sampling of air contaminants in the workplace in order to assess chemical exposure of the American working population. The characteristics of solid surface as they relate to sorption sampling are discussed. Topics discussed include not only the theoretical aspects of surface chemistry and sample retention performance, but also the development of monitoring hardware, the use of fluidized bed concepts, the collection of high volumes and the evaluation of a variety of sorbents for specific compounds. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N77-28264# Welding Inst., Cambridge (England).
SOLIDIFICATION CRACKING OF FERRITIC STEELS DURING SUBMERGED-ARC WELDING
N. Bailey and S. B. Jones 1977 27 p Sponsored by the 3350/5500 Sponsor Group
Copyright. Avail: Issuing Activity

Solidification cracking during submerged arc welding was investigated. The factors influencing the incidence of solidification cracking were studied as well as methods of avoiding defects in crack susceptible situations. Author

N77-28265* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BIMETALLIC JUNCTIONS Patent
Frank G. Arcella (Westinghouse Corp, Pittsburgh), Gerald G. Lessmann (Westinghouse Corp, Pittsburgh), and Russell A. Lindberg, inventors (to NASA) Issued 5 Jul. 1977 5 p Filed 24 Oct. 1975 Supersedes N76-13267 (14 - 04, p 0429)
(NASA-Case-LEW-11573-1; US-Patent-4,033,504; US-Patent-Appl-SN-625733; US-Patent-Class-228-190; US-Patent-Class-228-194; US-Patent-Class-228-232) Avail: US Patent Office CSCL 11F

The formation of voids through interdiffusion in bimetallic welded structures exposed to high operating temperatures is inhibited by utilizing an alloy of the parent materials in the junction of the parent materials or by preannealing the junction at an ultrahigh temperature. These methods are also used to reduce the concentration gradient of a hardening agent.
Official Gazette of the U.S. Patent Ofice

N77-28266 Rensselaer Polytechnic Inst., Troy, N. Y.
THE INFLUENCE OF GROWTH RATE AND TEMPERATURE ON HIGH CYCLE FATIGUE OF DIRECTIONALLY SOLIDIFIED Al-Al3Ni EUTECTIC ALLOY Ph.D. Thesis
Gernant E. Maurer 1976 174 p
Avail: Univ. Microfilms Order No. 77-2830

High cycle fatigue tests were conducted on specimens of the Al-Al3Ni eutectic alloy unidirectionally solidified at selected rates from 0.5 cm/hr to 1200 cm/hr. Tests were conducted in air at 298 K, 458 K, and 683 K. Room temperature fatigue lives were independent of growth rate at low solidification rates (0.5 - 30 cm/hr), but markedly improved in samples grown at 1200 cm/hr. Materials grown at 30 cm/hr exhibited fatigue lives similar to those of lower growth rate materials, despite gross misalignment due to cellular growth. At 0.5 T sub m (458 K) and 0.75 T sub m (683 K), the fatigue lives of material grown at low solidification rates were dependent on growth rate. The dependence of fatigue life on growth rate at elevated temperatures appears to result primarily from differences in

cyclic creep rates produced by varying interfiber spacings.
Dissert. Abstr.

N77-28267 Aeronautical Research Labs., Melbourne (Australia).
THE DISTRIBUTION OF FRACTURE TOUGHNESS DATA FOR D6ac STEEL
Jacqueline Coyle, J. M. Grandage, and D. G. Ford Aug. 1976 13 p refs
(ARL/Struc. Note-429) Copyright. Avail: Issuing Activity

Data on the fracture toughness of D6ac steel is analyzed for conformity with three probability distributions. The three parameter extreme value distribution is selected, and parameters are estimated for specified conditions. Author

N77-28268*# Martin Marietta Corp., Denver, Colo.
ENVIRONMENTAL EFFECTS ON ALUMINUM FRACTURE
Fred R. Schwartzberg and John A. Shepic Aug. 1976 63 p refs
(Contract NAS3-18923)
(NASA-CR-135182; MCR-76-385) Avail: NTIS HC A04/MF A01 CSCL 11F

The sustained load stress corrosion cracking (SCC) threshold for aluminum alloy 214 was determined using smooth (sigma sub TH) and precracked (K sub ISCC) specimens, and cyclic load growth behavior in 3.5% NaCl salt solution was studied. The relationship between K sub ISCC and sigma sub TH was also studied. The work showed that 2124-T851 aluminum alloy in plate gage has a moderately high resistance to stress corrosion attack. Experimental results showed that no SCC occurred in the longitudinal and long transverse directions in any of the tests. Some SCC was found by smooth tests in the short transverse direction, and the data were confirmed by two test methods-sigma sub TH = 275 MN/sq m (40 ksi). No SCC was found from compact specimen tests in any direction: surface flaw and center notch specimens evaluated in the short transverse direction exhibited SCC. The data indicate that stress corrosion behavior is defect, size, and stress dependent, but not entirely in accordance with a stress intensity controlled mechanism. Author

N77-28269*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CRYOGENIC PROPERTIES OF A NEW TOUGH-STRONG IRON ALLOY
Joseph R. Stephens and Walter R. Witzke Aug. 1977 13 p refs Presented at the 1977 Intern. Cryog. Mater. Conf., Boulder, Colo., 2-5 Aug. 1977
(NASA-TM-73691; E-9226) Avail: NTIS HC A02/MF A01 CSCL 11D

A program was undertaken to develop an iron-base alloy having a fracture toughness of 220 MPa. m superscript 1/2 with a corresponding yield stress of 1.4 GPa (200 ksi) at-196 C. An Fe-12Ni alloy was selected as the base alloy. Factors considered included reactive metal additions, effects of interstitial impurities, strengthening mechanisms, and weldability. The goals were met in an Fe-12Ni-0.5Al alloy strengthened by thermomechanical processing or by precipitate strengthening with 2 percent Cu. The alloy is weldable with the weld metal and heat affected zone in the postweld annealed condition having toughness equivalent to the base alloy. Author

N77-28270# Argonne National Lab., Ill.
METALLURGY, FABRICATION, AND SUPERCONDUCTING PROPERTIES OF MULTIFILAMENTARY Nb3Al COMPOSITES
J. W. Hafstrom 1976 4 p Presented at Applied Superconductivity Conf., Stanford, Calif., 17 Aug. 1976
(Contract W-31-109-eng-38)
(CONF-760829-51) Avail: NTIS HC A02/MF A01

The control of metallurgical structure during fabrication that will improve the superconducting properties of multifilamentary, aluminum-stabilized, Nb3Al composite is described. Composites are fabricated by placing niobium rods in an aluminum matrix, and then drawing to wire. Nb3Al is formed at temperatures exceeding 1800 C for about 5 s and ordered at 750 C for 48 h. Attempts to improve J/sub c/(H) by controlling the grain size in the Nb3Al diffused layer are discussed. Precipitates, arising from the addition of carbon during Nb3Al layer growth, do not appear to be effective as grain-boundary or flux pinners. When 1 percent Zr is added to the Nb, the growth of the Nb3Al layer is accelerated, T/sub c/ is lowered and J/sub c/(H) is not significantly improved. ERA

N77-28271# Cornell Univ., Ithaca, N.Y.
VACANCY DEFECT MOBILITIES AND BINDING ENERGIES OBTAINED FROM ANNEALING STUDIES
R. W. Balluffi Nov. 1976 60 p refs Presented at the Intern. Conf. on Properties on Atomic Defects on Metals, Argonne, Ill., 18 Oct. 1976
(Contract EY-76-S-02-2679)
(COO-2679-8; Conf-761027-13) Avail: NTIS HC A04/MF A01

A review is given of current knowledge of the mobilities and binding energies of vacancy defects in a number of FCC and BCC metals (i.e., Cu, Ag, Au, Pt, W and Mo) as derived from annealing experiments after quenching and/or irradiation. It is concluded that vacancy defects are retained by quenching in all of these metals, and that Stage 3 annealing after irradiation occurs by the migration of vacancy type defects. ERA

N77-28272# Argonne National Lab., Ill.
EFFECTS OF INTERSTITIAL TRAPPING AND RADIATION-INDUCED SEGREGATION ON VOID FORMATION IN NICKEL BERYLLIUM ALLOYS
P. R. Okamoto, N. Q. Lam, H. Wiedersich, and A. Taylor 1976 10 p refs Presented at 23d National Vacuum Symp. Chicago, 21 Sep. 1976
(Contract W-31-109-eng-38)
(CONF-760921-6) Avail: NTIS HC A02/MF A01

An investigation of void formation in Ni(58)+ ion irradiated dilute Ni-Be alloys was initiated. The effects of the irradiation parameters, irradiation temperatures, irradiation dose and dose rate, and alloy composition on the irradiation microstructure of alloys containing 0.1, 0.3, and 0.7 at. percent Be bombarded at doses up to 30 dpa at temperatures of 425, 525, and 625 C are investigated. The results of the electron microscopy of these irradiations are presented and compared with a recently developed swelling theory which takes into account both interstitial trapping and radiation induced solute segregation. ERA

N77-28273# Argonne National Lab., Ill. Materials Science Div.
EFFECTS OF DEFECT TRAPPING AND SOLUTE SEGREGATION ON DEFECT RECOMBINATION RATES AND VOID SWELLING IN IRRADIATED ALLOYS
P. R. Okamoto, N. Q. Lam, H. Wiedersich, and R. A. Johnson 1976 12 p refs Presented at the Intern. Conf. on the Properties of Atomic Defects in Metals, Argonne, Ill., 18-22 Oct. 1976
(Contract W-31-109-eng-38)
(CONF-761027-12) Avail: NTIS HC A02/MF A01

A model describing the synergistic effects of defect trapping and solute segregation on defect recombination rates and void-growth rates in irradiated alloys is discussed. The model predicts that solute depletion by radiation induced segregation reduces trapped defect recombination. Further, for a given defect production rate, segregation causes the temperature for minimum defect recombination and, hence, maximum swelling to shift to lower temperatures. The shift increases as the binding energies and/or initial solute concentrations increase. The model also predicts that, for the same initial solute concentration and binding energy, segregation will be more severe and swelling resistance less at fast reactor irradiation rates than at charged particle irradiation rates. ERA

N77-28274# Argonne National Lab., Ill.
STRUCTURAL MODELS FOR AMORPHOUS TRANSITION METAL BINARY ALLOYS
W. Y. Ching and C. C. Lin 1976 11 p refs Presented at 2d Intern. Symp. on Amorphous Magnetism, Troy, N. Y., 25 Aug. 1976
(Contract W-31-109-eng-38)
(CONF-760845-3) Avail: NTIS HC A02/MF A01

A dense random packing of 445 hard spheres with two different diameters in a concentration ratio of 3:1 was hand-built to simulate the structure of amorphous transition metal-metalloid alloys. By introducing appropriate pair potentials of the Lennard-Jones type, the structure is dynamically relaxed by minimizing

the total energy. The radial distribution functions (RDF) for amorphous Fe sub 0.75P sub 0.25, Co sub 0.75P sub 0.25 are obtained and compared with the experimental data. The calculated RDF's are resolved into their partial components. The results indicate that such dynamically constructed models are capable of accounting for some subtle features in the RDF of amorphous transition metal-metalloid alloys. ERA

N77-28275# Atomics International, Golden, Colo. Rocky Flats Plant.
QUALITY ENGINEERING AND CONTROL Semiannual Progress Report, May - Oct. 1976
20 Dec. 1976 19 p
(Contract EY-76-C-04-3533)
(RFP-2567) Avail: NTIS HC A02/MF A01

Varying methods of laboratory analysis applicable to absorption spectroscopy, electrolysis, gas chromatography, emission spectrometry, and infrared spectroscopy are described. Specific topics discussed include: silicon in steels and plutonium silicon alloys; removal of plutonium from process waste streams; and determination of phosphate ester in methanol. Headspace gas sampling methods are also considered. J.M.S.

N77-28276# Westinghouse Hanford Co., Richland, Wash.
CREEP AND RUPTURE BEHAVIOR OF WELD-DEPOSITED TYPE 16-8-2 STAINLESS STEEL AT 593 C
A. L. Ward and L. D. Blackburn Mar. 1976 35 p refs
(Contract E(45-1)-2170)
(HEDL-SA-837) Avail: NTIS HC A03/MF A01

The creep and rupture behavior of weld-deposited Type 16-82 stainless steel at 593 C was investigated. Equations relating stress to the time to rupture, the time to the onset of tertiary creep, and the time to produce a given creep strain were obtained. The experimental results indicate that the control of welding parameters within reasonable ranges yield weld deposits with consistent time dependent properties. Limited data suggest that high temperature (1065 C) post weld annealing significantly alters only the flow curve for plastic deformation, while long term thermal exposure at an intermediate temperature (565 C) produces only minor changes in either the plastic deformation or creep behavior of the weld materials. ERA

N77-28277# California Univ., Berkeley. Lawrence Berkeley Lab.
OPTIMAZATION OF STRENGTH AND TOUGHNESS IN A HIGH CARBON STEEL
Rameshchandra J. Kar Dec. 1976 80 p refs
(Contract W-7405-eng-48)
(LBL-5448) Avail: NTIS HC A05/MF A01

Ball bearing grade E52100 steel and two of its Si modifications (1 wt% and 2 wt% Si) are examined for improved mechanical properties. Hardness, tensile and toughness testing were performed. Optical and scanning electron microscopy were used to correlate microstructure with observed mechanical properties. It is found that use of high austenitization temperatures and/or Si modification give large amounts of retained austenite. Isothermal transformations subsequent to single or two cycle austenitization give mixed microstructures of lower bainite, martensite and retained austenite. These offer the potential of achieving high strength-toughness combinations. ERA

N77-28278# California Univ., Berkeley. Lawrence Berkeley Lab.
INTERRELATIONSHIPS BETWEEN THERMAL HISTORY AND MECHANICAL PROPERTIES OF A SECONDARY HARDENING STEEL
Nareshchandra J. Kar Dec. 1976 83 p refs
(Contract W-7405-eng-48)
(LBL-5449) Avail: NTIS HC A05/MF A01

Commercial secondary hardening steel, VASCO MA, was subjected to modified heat treatments to introduce mixed microstructures of martensite and lower bainite. Dilatometry, tensile testing, hardness measurements, and slow-bend testing were carried out and the mechanical properties obtained were correlated to microstructure using scanning electron microscopy and metallography. Duplex microstructures containing small amounts of lower bainite are found to show an increased toughness on tempering in the secondary hardening range, as compared to initially fully martensitic microstructures. As the percentage of lower bainite in the duplex microstructures is increased, the secondary hardening peak is found to attenuate. The effect of different austenitization treatments on the secondary hardening behavior, was also studied. Thermal cycling at lower austenitization temperatures is found to reprecipitate out carbon, which was taken into solution in earlier high temperature austenitization. ERA

N77-28279# Naval Ship Research and Development Center, Annapolis, Md. Materials Dept.
ADHESION PROMOTERS FOR BONDING TITANIUM Interim Report
M. E. Schrader and J. A. Cardamone Apr. 1977 14 p
(AD-A038549; MAT-76-39) Avail: NTIS HC A02/MF A01 CSCL 11/1

An investigation was undertaken to determine the feasibility of using adhesion promoters to improve the interfacial bond between titanium and structural adhesives. The dry and wet strengths of titanium/epoxy/titanium lap-shear joints were determined, utilizing gamma-aminopropyltriethoxysilane as the adhesion promoter. The lap-shear joints using gamma-aminopropyltriethoxysilane were found to be approximately 25% stronger dry and more than 50% stronger after water exposure than joints prepared with standard surface treatments. GRA

N77-28280# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
MACHINE CASTING OF HIGH TEMPERATURE ALLOYS FOR TURBINE ENGINE COMPONENTS Interim Report, 1 Mar. - 31 Aug. 1976
L. F. Schulmeister, J. D. Hostetler, C. C. Law, and J. S. Erickson Feb. 1977 50 p refs
(Contract DAAG46-76-C-0029; ARPA Order 2267)
(AD-A038521; PWA-5490-1; AMMRC-CTR-77-6) Avail: NTIS HC A03/MF A01 CSCL 21/5

A program has been initiated to evaluate the capability of machine casting for fabricating components for gas turbine engines such as compressor airfoils. The goal is to evaluate the capability of the process to produce an end product of high quality on an economic basis. During this reporting period, machine casting activity consisted of continuing equipment modifications to an already existing unit which improved die filling and decreased transfer time. Concurrently, partial assessment of process parameter effects using Rheocast Haynes Alloy 31 (X-40) cobalt-base alloy as a vehicle was performed. Machine casting preforms containing varying volume fractions of solid were injected at different die temperatures. Evaluation of the resultant product indicated that internal porosity was much lower in those parts made from initially high volume fraction solid preforms and that surface condition was improved with increasing die temperature. In addition to the above work, a heat treatment response study was performed and some limited mechanical property evaluation was conducted. Heat treatment studies indicated that long term annealing followed by aging yielded microstructures similar to those of the conventionally cast and heat treated Haynes 31 alloy, indicating the ability to largely eliminate those chemical heterogeneities peculiar to the thixotropic state of the input material. Tensile testing at room temperature and 1000 F indicated that yield strengths were higher than the nominal yield strengths for conventionally investment cast X-40 at both temperatures, while both ductility and ultimate strengths were somewhat lower. GRA

N77-28281# Naval Surface Weapons Center, White Oak, Md.
HIGHLY MAGNETOSTRICTIVE RARE EARTH IRON ALLOYS
A. E. Clark 1 Dec. 1976 48 p refs
(RR0220601)
(AD-A038251; NSWC/WOL/TR-76-99) Avail: NTIS HC A03/MF A01 CSCL 20/3

Since 1963, it has been known that the rare earth elements possess extraordinary magnetostrictions (approx. .06), far in excess of those characteristic of the magnetic transition metals and alloys. These magnetostrains, however, are available only at cryogenic temperatures. Within the last few years, magnetostrictive strains exceeding .002500 have been achieved at room temperature in rare earth alloys containing Tb and Fe. These alloys

possess the largest known room temperature magnetostrictions by far and maintain the largest known magnetomechanical coupling factor (k = 0.6) over wide ranges in applied fields. Recently, both positive and negative magnetostrictive materials have been examined. In this technical report, an introduction to the highly magnetostrictive rare earths is given. Measurements on polycrystals and single crystals are presented. The importance of grain orientation in the fabrication of transducer elements is established. Author (GRA)

N77-28282# Wright State Univ., Dayton, Ohio. Dept. of Engineering.

LIFE PREDICTION TECHNIQUES FOR ANALYZING CREEP-FATIGUE INTERACTION IN ADVANCED NICKEL-BASE ALLOYS Final Technical Report, 8 Jul. 1975 - 7 Jul. 1976

M. N. Menon Wright-Patterson AFB, Ohio AFML Nov. 1976 65 p refs

(Contract F33615-76-C-5030; AF Proj. 2279)

(AD-A038069; AFML-TR-76-172) Avail: NTIS HC A04/MF A01 CSCL 11/6

On the basis of the limited data that are presented in this study, it may be concluded that the effect of creep damage on the low cycle fatigue behavior of Rene 95 at 1200 F is not very severe. This is probably because of the good stress rupture properties of the material at this temperature. Strain Range Partitioning approach does not seem to hold much promise for analyzing, and therefore, for predicting strain controlled low cycle fatigue behavior of Rene 95 under creep-fatigue conditions at 1200 F. When compared to the SRP approach, the Frequency Modified approach appears less cumbersome and, hence, more advantageous. The present study indicates, however, that the FM approach using the frequencies calculated on the basis of the actual cycles holds only a slight edge over that involving unmodified inelastic strain range versus cyclic life representation. At present, the damage approach proposed by Ostergren seems to offer more potential as it takes into account the aspect of loop shift that accompanies fatigue cycling of Rene 95. GRA

N77-28283# General Dynamics/Fort Worth, Tex.

DEVELOPMENT OF A WELDABLE HIGH STRENGTH STEEL (VIM/ESR PROCESSING) Final Report, Jul. 1975 - Jul. 1976

P. M. Machmeier Wright-Patterson AFB, Ohio AFML Dec. 1976 42 p refs Prepared in cooperation with Nutek Materials, Corp., Pittsburgh

(Contract F33615-73-C-5093; AF Proj. 7351)

(AD-A038072; AFML-TR-76-217) Avail: NTIS HC A03/MF A01 CSCL 11/6

A recently developed, VIM/VAR melted, high strength-toughness 14Co-10Ni-2Cr-1Mo-0.16C alloy steel (AF 1410) was selected as a candidate to evaluate the electroslag remelting process for high purity alloys. The principal goals in this investigation were the improvement in melt production economy and flexibility inherent to the ESR process with a minimal loss in toughness properties at desired strength levels. GRA

N77-28284# IBM Watson Research Center, Yorktown Heights, N.Y.

SPECTROSCOPIC STUDIES OF CHEMICAL ADSORPTION AND REACTIONS AT TRANSITION METAL SURFACES Final Report, 1 Jan. 1975 - 31 Dec. 1976

J. E. Demuth and G. W. Rubloff 15 Mar. 1977 149 p refs (Contract N00014-75-C-0346)

(AD-A038084) Avail: NTIS HC A07/MF A01 CSCL 11/6

The accomplishments of the work under the title 'Spectroscopic Studies of Chemical Adsorption and Reactions at Transition Metal Surfaces' are summarized. Included are studies of flat and stepped surfaces, of surfaces with chemisorbed species and of reactions on these surfaces. Experimental techniques utilized include ultraviolet photoemission spectroscopy, optical reflectance spectroscopy, photoelectron yield spectroscopy, and thermal desorption mass spectroscopy. GRA

N77-28285# George Washington Univ., Washington, D.C. Inst. for the Study of Fatigue Fracture and Structural Reliability.

A: MECHANICAL PROPERTIES OF ANNEALED AND MARTENSITIC Ti-6Al-4V. B: MICROSTRUCTURE OF SOLUTION TREATED Ti-6-Al-4V. C: A STUDY OF FATIGUE DAMAGE WITH ULTRASONIC INTERNAL FRICTION MEASUREMENTS

C. M. Gilmore Aug. 1976 72 p refs

(Contract N00019-76-C-0136)

(AD-A038412; TR-3) Avail: NTIS HC A04/MF A01 CSCL 11/6

Fatigue life studies are reported on annealed microstructures and on solution treated plus quenched microstructures, and it was found that specimens solution treated at about 900 C (1650 F) had the longest fatigue life, longer by at least a factor of four. The microstructure of solution treated and quenched Ti-6Al-4V is reported with particular emphasis on the solution temperature of 900 C (1650 F). It is proposed that it is the strain induced transformation of retained beta phase to martensite that is producing the improved fatigue life of this alloy. Internal friction measurements using a resonance technique at kilohertz (17650 Hz) frequency were made on Ti-6Al-4V that had been subject to cyclic fatigue loading. The measurements showed that the internal friction increased as the fatigue damage was increased. GRA

N77-28286# Army Materials and Mechanics Research Center, Watertown, Mass.

SPECTROCHEMICAL ANALYSIS OF BORON CARBIDE BY POWDER TECHNIQUES Final Report

Bernard H. Strauss and Fred G. Howell Feb. 1977 15 p

(AD-A038838; AMMRC-TR-77-6) Avail: NTIS HC A02/MF A01 CSCL 11/6

A method for the determination of impurities in boron carbide was developed using powder techniques. The elements aluminum, calcium, iron, magnesium, manganese, nickel, silicon, titanium, and vanadium were determined over concentration ranges between 10 and 24,000 parts per million. The boron carbide powder was mixed with buffers including an internal standard. These sample mixtures were excited in a direct current arc and spectra recorded on photographic plates. Due to a lack of standard boron carbide samples, the analytical curves are based on the wet chemical analysis of six samples. Dilution with graphite was employed to extend the analytical curves of the higher levels elements (Aluminum, calcium, iron, and silicon) down to 100 ppm or less. Author (GRA)

N77-28287# Army Materials and Mechanics Research Center, Watertown, Mass.

MONOTONIC AND LOW-CYCLE FATIGUE RESPONSE OF A MARAGING STEEL AND METASTABLE BETA TITANIUM ALLOY UNDER TORSIONAL LOADING Final Report

Peter T. Lum and Richard Chait Feb. 1977 15 p

(AD-A038837; AMMRC-TR-77-4) Avail: NTIS HC A02/MF A01 CSCL 11/6

This study deals with the torsional response of Ti-8823 and 18Ni (200) maraging steel. The effect of different heat treatments and the subsequent change in microstructure are investigated. In the case of the Ti-8823, a comparison was made between the solution-treated-and-aged condition, and the direct-aged condition. It was found that the finer precipitate morphology in the DA material offered a greater resistance to torsional fatigue. For the 18Ni (200) maraging steel, an increase of aging time from 3 to 98 hours led to a substantial increase in the amount of reverted austenite, which in turn led to a significant improvement in torsional fatigue behavior. The results are analyzed in terms of the Manson-Coffin equation. Author (GRA)

N77-28288# Naval Air Development Center, Warminster, Pa. Dept. of Air Vehicle Technology.

GLYCOL QUENCHING OF 7050-T736 ALUMINUM ALLOY PLATE Progress Report

S. J. Ketcham 11 Mar. 1977 12 p

(AD-A038998; NADC-77084-30) Avail: NTIS HC A02/MF A01 CSCL 11/6

A study was conducted to determine the effect of glycol quenching on the mechanical properties of 7,050-T736 plate as compared with water quenching. Results indicate glycol quenching does not achieve equivalent properties in plate up to 50.8 mm (2 in.). Use of glycol quenchants for 7,050 plate is not recommended unless reduction in design allowables can be tolerated. Author (GRA)

N77-28289# Naval Postgraduate School, Monterey, Calif.
HIGH STRENGTH TO WEIGHT ALUMINUM: 18 WEIGHT PERCENT MAGNESIUM ALLOY THROUGH THERMAL MECHANICAL PROCESSING M.S. Thesis
Frank George Ness, Jr. Dec. 1976 63 p refs
(AD-A038760) Avail: NTIS HC A04/MF A01 CSCL 11/6

An aluminum-18 weight percent magnesium alloy was prepared by casting and then warm rolling at 425 C to 94% true strain. This alloy was compression tested at six strain rates from 0.00664 per minute to 0.332 per minute and at eight temperatures ranging from 25 C to 425 C. The most significant result is that a warm rolled aluminum-18 weight percent magnesium alloy can exhibit compressive strengths in excess of 95 ksi, in a material of 10% lower density than commercial high strength aluminum alloys. Author (GRA)

N77-28290# Missouri Univ., Columbia. Coll. of Engineering.
INFLUENCE OF MICROSTRUCTURAL AND LOAD WAVE FORM CONTROL ON FATIGUE CRACK GROWTH BEHAVIOR OF PRECIPITATION HARDENING STAINLESS STEELS Ph.D. Thesis
Kevin Richard Kondas Jul. 1976 316 p refs
(Contract N00014-75-C-0670)
(AD-A036275) Avail: NTIS HC A14/MF A01 CSCL 11/6

The scientific hypothesis of this work is that microstructure when acted upon by load and environment determines the fatigue-crack growth rates or life of a component. The experimental approach varied the heat treatment of two precipitation hardening martensitic alloys, 17-4 PH and 15-5 PH. Fatigue-crack growth data was correlated between materials cycled under wave forms of 10 Hz sine frequency and trapezoidal one minute hold-time for different stress range ratios and environments. GRA

N77-28291# Battelle Columbus Labs., Ohio.
DIRECTIONALLY SOLIDIFIED IN SITU METAL MATRIX COMPOSITES, PART 2 Final Report
G. Haour, F. Mollard, B. Lux, and I. G. Wright Nov. 1976 41 p refs Prepared in cooperation with Battelle Memorial Inst., Geneva
(Contract N00019-74-C-0409)
(AD-A036385) Avail: NTIS HC A03/MF A01 CSCL 11/6

This work constitutes Part II of an alloy screening program to identify new eutectics based on Ni, Co and Fe suitable for the manufacture of directionally solidified turbine blades operating at up to 1150 C. During this Part II, thirteen alloy systems, selected for screening during Part I, have been experimentally investigated, leading to the identification of three eutectics of potential interest: Co-Al-Cr, Co-Si-Nb and Co-Cr-Zr. As a result of the overall program, Part I and Part II, a total of 9 eutectics have thus been found to meet the objectives of a melting point above 1200 C, a specific gravity below 9 g/cc and a reasonably low parabolic oxidation rate. These eutectics thus have, before any development, an oxidation resistance comparable or superior to the chromium free gamma/gamma-delta eutectic superalloy Ni-2.55 Al-21.75 Nb (wt %). It is therefore expected that an alloy optimization program would improve their oxidation behavior, as compared to the gamma/gamma-delta alloy with 6% chromium, presently the most advanced eutectic of this class of materials. GRA

N77-28292# Solar, San Diego, Calif.
TITANIUM BRAZE SYSTEM FOR HIGH TEMPERATURE APPLICATIONS Final Technical Report, 7 May 1974 - 30 Apr. 1976
C. E. Smeltzer and A. N. Hammer Wright-Patterson AFB, Ohio AFML Aug. 1976 149 p refs
(Contract F33615-74-C-5118; AF Proj. 7351)
(AD-A036575; RDR-1786-6; AFML-TR-76-145) Avail: NTIS HC A07/MF A01 CSCL 11/6

This report describes the design rationale and development of special, high-temperature braze systems for joining titanium and titanium alloys, suitable for long term aerospace application to 800 F. Candidate braze alloy designs were substrate-compatible, low-melting (1650-1750 F) compositions within the metallurgically similar Ti, Zr-, Ti-Zr, Ti-V, and Zr-V-Ti (base) systems. Best results were obtained with the Ti-Zr system. Desired hypoeutectic structure and melt-solidification behavior were achieved wherever possible through controlled reduction of major melting-point depressants and/or Zr/Ti ratios, backing-off from eutectic alloying levels. Principal alloying objectives were (a) braze strength, toughness and ductility properties (RT-800 F) comparable to the high-melting Ti-15Cu-15Ni baseline braze alloy, (b) conventional brazing characteristics superior to the baseline braze, particularly brazing capability less than or equal to 1750 F to avoid 'beta embrittlement' of the substrate (Ti-6Al-4V) and (c) intrinsic long-term resistance to structural damage from aqueous salt spray, 800 F air oxidation, and 800 F hot-salt corrosion. Over 350 different braze alloy designs were evaluated through various screening tests. The two braze alloy designs which best met program objectives are designated AC5-16 (Ti-27.2Zr-15.0Ni-7.0Cu) and AC1-20 (Ti-28.8Zr-28.0Cu). The principal substrate alloy employed was Ti-6Al-4V; some comparison tests were conducted with Beta-C substrate alloy. GRA

N77-28293# Pennsylvania State Univ., University Park. Dept. of Materials Science.
EFFECT OF ELECTRODEPOSITED METALS ON THE PERMEATION OF HYDROGEN THROUGH IRON MEMBRANES Progress Report
S. S. Chatterjee, B. G. Ateya, and H. W. Pickering Feb. 1977 26 p refs
(Contract N00014-75-C-0264)
(AD-A036583; TR-8) Avail: NTIS HC A03/MF A01 CSCL 11/6

The permeability of electrolytically charged hydrogen through annealed Ferrovac E iron memebranes was found to decrease significantly upon coating the charging surface of iron with thin layers of either Pt, Cu or Ni (Watts or electroless). The absorption of hydrogen was delayed for a period which depends on the nature and the thickness of the metallic coating. The results show that such coatings do not have to be thick or even continuous to be effective, in which case a catalytic mechanism is proposed to explain the marked reduction in hydrogen permeation through the iron. Experimental confirmation is presented of this catalytic mechanism and of the barrier mechanism which is operative in the presence of a thick continuous coating. It is also shown that the domains of each mechanism can be determined by simple calculations from first principles. Author (GRA)

N77-28294# Rock Island Arsenal, Ill. General Thomas J. Rodman Lab.
WEAR CHARACTERISTICS OF SPUTTERED VERSUS ELECTROPLATED CHROMIUM ON ALUMINUM
Andrew Crowson Jan. 1977 38 p refs
(AD-A036444; RIA-R-TR-77-003) Avail: NTIS HC A03/MF A01 CSCL 19/6

The wear characteristics of sputtered chromium coatings on aluminum 7075 substrates were investigated and compared with electroplated chromium coatings. Both types of coatings were tested on a LFW-1 machine of the flat-on-cylinder variety under oscillating contact conditions. The structural characteristics of each type of chromium coatings have a definite relationship to the type of wear observed. The electroplated coated rings exhibited negligible wear during the initial cycle but eventually failed catastrophically by flaking and shearing of the deposits owing to its residual stress and cracked microstructure. The sputtered coatings, on the other hand, were found to be devoid of the residual stresses and cracked microstructure prevalent for the electroplated coatings. A conical-or columnar- shaped microstructure was exhibited. A uniform wear rate and lower overall wear of the sputtered coating was attributed to this microstructure and absence of gross defects. Evidence of abrasion and localized plastic flow on the sputtered wear surface was noted. Author (GRA)

N77-28295# Rome Air Development Center, Griffiss AFB, N.Y.
INVESTIGATION AND DEVELOPMENT OF METHODS TO INCREASE THE DISPERSIBILITY OF ALUMINUM METAL POWER
K. P. Quinlan and J. J. Hutta Jan. 1977 32 p refs
(AD-A036330; RADC-TR-76-381) Avail: NTIS HC A03/MF A01 CSCL 07/4

A study was undertaken to eliminate or significantly reduce agglomeration of an aluminum powder composed of spherical particles in the size range 2 to 5 micrometers. The investigation was carried out using three approaches: (1) addition of

free-flow materials to the aluminum powders; (2) application of coatings on the aluminum particles; and (3) chemical modification of the aluminum surface. Evaluations of the treatments were accomplished by visual observation, elutriation, and sieve analyses. Three treatments were found to give superior dispersible aluminum powders: addition of activated carbon, addition of Tullanox-500, and surface treatment of the aluminum spheres with water followed by drying with acetone. Tests performed by MIT Lincoln Laboratory showed that these treated aluminum powders could be ideally dispersed with no subsequent agglomeration.
Author (GRA)

N77-28296# National Bureau of Standards, Washington, D. C. Corrosion and Electrodeposition Section.
DEVELOPMENT OF IN-SITU TECHNIQUES FOR THE DETECTION AND MEASUREMENT OF CORROSION OF COPPER CONCENTRIC NEUTRALS IN UNDERGROUND ENVIRONMENTS Annual Report, 15 Jan. 1976 - 15 Jan. 1977
J. Kruger, U. Bertocci, E. Escalante, and J. L. Mullen Apr. 1977 71 p
(Contract E(49-1)-3800)
(PB-265672/6; NBSIR-77-1232(ERDA); AR-1) Avail: NTIS HC A04/MF A01 CSCL 09A

Specimens of the wire underwent long term corrosion tests. Environmental variables examined were: (1) composition of electrolyte, (2) composition of the gaseous atmosphere, (3) convective motion in solution, (4) superimposed a.c. signal, and (5) coupling with conducting polyethylene (CPE). The results showed that accelerated attack with pit formation was caused by a.c. signal and that oxygen availability and presence of chloride ions in solution favored the attack of the wires. Potentiodynamic scans on the wires as well as on pure copper and tinning alloy were perfomed in various solutions. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N77-28297 Tennessee Univ., Knoxville.
SOLUTION PROPERTIES, CRYSTALLINITY AND MORPHOLOGY STUDIES OF AROMATIC POLYAMIDE AND ITS BLOCK COPOLYMERS Ph.D. Thesis
Yu-Der Lee 1976 231 p
Avail: Univ. Microfilms Order No. 77-3655

The purpose was to form a block polymer from a flexible segment and an aromatic polyamide which hopefully would add new characteristics to the aromatic polyamide behavior while not sacrificing the merits of this material. Objects of this research include characterization of solution behavior, morphology and crystallography studies of a series poly(m-phenylene isophthalamide) and its block copolymers. The synthesis of these polymers was done by Zdrahala (216). A series of 18 poly(m-phenylene isophthalamide) homopolymers, 30 block copolymers containing poly(m-phenylene isophthalamide) and poly(ethylene oxide) segments, and 22 block copolymers of poly(m-phenylene isophthalamide) with poly(dimethyl siloxane) were made. The continuing characterization of above materials was performed.
Dissert. Abstr.

N77-28298 Texas A&M Univ., College Station.
DETERMINATION OF NONLINEAR VISCOELASTIC PROPERTIES OF DILUTE DRAG REDUCING POLYMER SOLUTIONS BY A TRANSIENT RESPONSE METHOD Ph.D. Thesis
Chen Fai Tsai 1976 283 p
Avail: Univ. Microfilms Order No. 77-2675

Viscous and elastic rheological properties of three very dilute polymer solutions (100 to 500 parts per million) of a polyacrylamide in distilled water were determined. By using the Weissenberg rheogoniometer, both the apparent visocosity and first normal stress difference were obtained over a shear rate range from about 0.001 to 1500/sec. The transient response characteristics were determined by a specially designed transient rheometer with modification for increased resolution. A simple 5-parameter nonlinear constitutive equation was used to correlate the data and compare the transient response with that predicted by Carreau's 7-parameter model B. A modified Marquardt's method was used to estimate the model parameters and differential approximation technique was developed to evaluate the nonlinear convolution integral encountered in Carreau's model B for arbitrarily time varying shear rate flow. A generalization of a scaling method for solving the system equation is also presented. Dissert. Abstr.

N77-28299 Iowa Univ., Iowa City.
A PROBABILISTIC THEORY OF THE TIME TO FRACTURE OF AMORPHOUS CROSSLINKED POLYMERS Ph.D. Thesis
Uekue Yilmazer 1976 111 p
Avail: Univ. Microfilms Order No. 77-3783

An energy probability theory of global fracture is formulated using the notion of intrinsic time starting with first principles. Comparisons were made between the theory and experiments in the literature on styrene-butadiene rubbers. It is proposed that fracture occurs as a result of accumulation of broken carbon-carbon bonds. When a critical concentration or broken bonds is reached locally, catastrophic failure begins and the specimen fractures. It is assumed that the probability of fracture of a single carbon-carbon bond is determined by the energy content of the bond. Nonuniform distribution of the free energy of the specimen among bonds is also taken into account by means of an exponential dintribution function. The variation in spatial distribution of critical sites vulnerable for bond fracture is the cause of the scale effect and variability of lifetimes in identical specimens and test conditions. A theory for the variability of lifetimes is formulated and applied in creep conditions by assuming Weibull distribution for the global broken bond concentration necessary for fracture. Dissert. Abstr.

N77-28300*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.
A FUNDAMENTAL APPROACH TO ADHESION: SYNTHESIS, SURFACE ANALYSIS, THERMODYNAMICS AND MECHANICS Semiannual Report
David W. Dwight and James P. Wightman Jul. 1977 61 p refs
(Grant NsG-1124)
(NASA-CR-153911) Avail: NTIS HC A04/MF A01 CSCL 11A

The ability of SEM/EDAX to determine the physical and chemical composition of very small areas was used to study several diverse types of samples representative of NASA-LaRC technology. More systematic investigation was carried out on differences in the results of grit-blasting Ti 6-4 adherends and the presence of extraneous elements, primarily silicon, in some polymer/HT-S fiber composites. Initial results were obtained from a fractured (ILS) short-beam shear specimen, and from Ti 6-4 alloy, before and after a proprietary Boeing anodizing surface preparation for adhesive bonding. Photomicrographs and EDAX spectra were also obtained from new, fractured lap shear strength specimens that employed PPQ and LARC-13 adhesives. Author

N77-28301*# Solar Turbines International, San Diego, Calif.
DEVELOPMENT OF FIRE-RESISTANT, LOW SMOKE GENERATING, THERMALLY STABLE END ITEMS FOR AIRCRAFT AND SPACECRAFT Final Report
John Gagliani, U. A. K. Sorathia, and A. L. Wilcoxson Jun. 1977 130 p ref
(Contract NAS9-15050)
(NASA-CR-151472; SO6-4501-7; RDR-1826-9) Avail: NTIS HC A07/MF A01 CSCL 11G

Materials were developed to improve aircraft interior materials by modifying existing polymer structures, refining the process parameters, and by the use of mechanical configurations designed to overcome specific deficiencies. The optimization, selection, and fabrication of five fire resistant, low smoke emitting open cell foams are described for five different types of aircraft cabin structures. These include: resilient foams, laminate floor and wall paneling, thermal/acoustical insulation, molded shapes, and coated fabrics. All five have been produced from essentially the

same polyimide precursor and have resulted in significant benefits from transfer of technology between the various tasks. Author

N77-28302*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HIGH PURITY SILICA REFLECTIVE HEAT SHIELD DEVELOPMENT
Philip R. Nachtscheim and James C. Blome (McDonnell Douglas Astronautics Co., St. Louis, Mo.) Nov. 1976 40 p refs
(NASA-TM-X-73210; A-6938) Avail: NTIS HC A03/MF A01 CSCL 11G

A hyperpure vitreous silica material is being developed for use as a reflective and ablative heat shield for planetary entry. Various purity grades and forms of raw materials were evaluated along with various processing methods. Slip casting of high purity grain was selected as the best processing method, resulting in a highly reflective material in the wavelength bands of interest (the visible and ultraviolet regions). The selected material was characterized with respect to optical, mechanical and physical properties using a limited number of specimens. The process has been scaled up to produce a one-half scale heat shield (18 in. dia.) (45.72 cm) for a Jupiter entry vehicle. This work is now being extended to improve the structural safety factor of the heat shield by making hyperpure silica material tougher through the addition of silica fibers. Author

N77-28303# Aeronautical Research Council, London (England).
THE THEORY OF PARTIAL RETRACTION OF IMPERFECTLY ELASTIC ROPES
G. W. H. Stevens 1975 23 p refs Supersedes ARC-35795
(ARC-CP-1327; ARC-35795; ISBN-011-470937-8) Avail: NTIS HC A02/MF A01; HMSO £1.20

The theory of partial retraction of alinearly elastic ropes was developed and illustrated with data on dynamic behavior derived from slow-speed extension/recovery curves of nylon yarn and ropes. It is shown that the retraction velocities are less than those calculated by converting all the strain energy released into kinetic energy of motion but that they can still reach 100 m/s when the tension is relaxed by about 80%. The analysis illustrates the need for direct measurements of dynamic modulus and sonic velocity in ropes. Author

N77-28304*# Georgia Inst. of Tech., Atlanta.
LUBRICANT RHEOLOGY APPLIED TO ELASTOHYDRODYNAMIC LUBRICATION Final Report
Ward O. Winer and David M. Sanborn Washington NASA May 1977 214 p refs
(Grant NGR-11-002-133)
(NASA-CR-2837) Avail: NTIS HC A01/MF A01 CSCL 11H

Viscosity measurements in a high pressure rheometer, elastohydrodynamic simulator studies (including the development of a temperature measuring technique), and analytical fluid modeling for elastohydrodynamic contacts are described. The more recent research which is described concerns infrared temperature measurements in elastohydrodynamic contacts and the exploration of the glassy state of lubricants. A correlation, of engineering significance, was made between transient surface temperature measurements and surface roughness profiles. Measurements of glass transitions of lubricants and the study of the effect of rate processes on materials lead to the conclusion that typical lubricants go into the glassy state as they pass through the contact region of typical elastohydrodynamic contacts. Author

N77-28305# Northwestern Univ., Evanston, Ill.
BASIC RESEARCH ON CERAMIC MATERIALS FOR ENERGY STORAGE AND CONVERSION SYSTEMS Progress Report, 1 Dec. 1975 - 30 Nov. 1976
Donald H. Whitmore Dec. 1976 35 p refs
(Contract EY-76-S-02-2564)
(COO-2564-2) Avail: NTIS HC A03/MF A01

Experimental probes for measuring the movement of ionic and electronic charge carriers in ceramic materials suitable for solid electrolyte and electrode applications in high-performance, secondary battery and fuel cell systems were utilized. Special emphasis is placed on developing: (1) a better understanding of the effects of structure, impurities and composition on charge carrier transport mechanisms in such materials; and (2) detailed knowledge of the kinetics and mechanism of reactions occurring (on a microspcopic scale) at the electrode-electrolyte interfaces of energy storage and conversion systems. ERA

N77-28306# Firestone Tire and Rubber Co., Akron, Ohio. Central Research Labs.
FABRICATION OF A LOW TEMPERATURE FUEL HOSE PHOSPHONITRILIC FLUOROELASTOMER Final Report
T. A. Antkowiak and D. L. Welvaert Nov. 1976 126 p
(Contract DAAG53-75-C-0187; DA Proj. 1G7-62708-AH-67)
(AD-A036903; Rept-1432-1) Avail: NTIS HC A07/MF A01 CSCL 13/11

This report discusses work directed toward preparation of fuel resistant hose that is serviceable at temperatures as low as -70 F. The bulk of the report describes compounding studies which attempted to provide a balance of the properties suitable for Arctic fuel hose. A description is also provided of the fabrication of large lengths of collapsible and suction type hoses. It was found that the polymer, PNR-LT, a modified phosphonitrilic fluoroelastomer, could be compounded to permit production of Arctic fuel hoses which possess good low temperature flexibility. The hoses possessed good dimensional stability and physical strength, but tensile and tear strengths on samples from the hoses were lower than desired. Author (GRA)

N77-28307# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
EVALUATION OF POLYPROPYLENE AND POLYETHYLENE CUSHION WRAP MATERIALS
Richard V. Brown Apr. 1977 20 p
(AD-A039089; PTPT-77-17) Avail: NTIS HC A02/MF A01 CSCL 11/9

The objective of this study was to evaluate the static and dynamic cushioning properties of polyethylene wrap material in relation to polypropylene wrap material and to determine the relative cost effectiveness of the two materials in package designs. Peak acceleration (Gs) versus Static Stress curves and 'Creep' characteristics were developed for both materials. Using these data and a mathematical model, a cost analysis was accomplished. The results showed that no cost savings could be realized by substituting polyethylene for polypropylene. However, polyethylene should be considered as an alternative to polypropylene in new pack designs when item fragility and static bearing stress considerations result in equivalent material costs. Author (GRA)

N77-28308# Dayton Univ. Research Inst., Ohio.
DETERMINATION OF PHYSICAL PARAMETERS FOR POLYMERIC MATERIALS USING ULTRASONICS TECHNIQUES. LONGITUDINAL AND SHEAR MEASUREMENTS ON COMMERCIALLY AVAILABLE PLASTICS Final Report, Sep. 1975 - Feb. 1976
D. R. Wiff and David E. Wright Wright Patterson AFB, Ohio AFML Dec. 1976 45 p refs
(Contract F33615-75-C-5095; AF Proj. 7340)
(AD-A038075; AFML-TR-76-239) Avail: NTIS HC A02/MF A01 CSCL 11/9

The background theory used in understanding longitudinal and shear velocities in isotropic and anisotropic materials is summarized. The relation of these velocities to mechanical property evaluation is presented. The derived expressions are applied. An ultrasonics apparatus was used to measure longitudinal and shear velocities in a variety of commercially available semicrystalline polymers. Measured results agree well with other published values. The use of this ultrasonic technique for polymer characterization is discussed. GRA

N77-28309# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
THE LUBRICATING CHARACTER OF GREASES USING A NEW TEST METHOD Final Scientific Report, 30 Jun. - 31 Oct. 1976
T. N. Mills and Alastair Cameron 4 Apr. 1977 27 p refs
(Grant AF-AFOSR-3088-76; AF Proj. 9767)
(AD-A038793; EOARD-TR-77-02) Avail: NTIS HC A03/MF A01 CSCL 11/8

A slow-speed high frequency reciprocating test rig was used to investigate the behavior of a lubricated sliding contact when subjected to repeated slow-speed passes within times comparable

to the reaction rates of chemically acting lubricant additives. Such conditions are similar to the working environment of a lubricant and tests carried out using this test rig are shown to reveal more information than may be obtained otherwise. The report presents a brief description of the test rig and the results of tests made on a series of ammeline and teflon greases using this new method. The results of tests on a commercial mineral oil are also included. Author (GRA)

N77-28310# Naval Research Lab., Washington, D. C.
SCANNING ELECTRON MICROSCOPY OF RUBBER TEAR Final Report, 1 Oct. 1976 - 1 Mar. 1977
Willard D. Bascom Apr. 1977 24 p
(AD-A038912) Avail: NTIS HC A02/MF A01 CSCL 11/10

A simple technique was devised for SEM observation into tears or cuts in rubber or other flexible polymers. A rectangular specimen (about 2 x 1 x 0.5 cm) was held in a bent configuration in a SEM holder and a shallow razor cut made at the top of the bend. Tensile stresses caused the rubber to tear and advanced the cut depth. Observing along the tearing direction, the highly stressed rubber at the tear tip (damage zone) could be observed in detail. A number of commercial rubbers including natural, nitrile, neoprene, polybutadiene and fluorocarbon compositions were examined using this technique. Initially, the stressed rubber at the tear tip was more or less continuous although some structure and occasionally cavitation were observed at high magnifications (= 5,000X). Removal of the specimens from the microscope and exposure to laboratory air resulted in gradual (2-20 hr) development of an open network of fibers and nodules, due to an oxygen/ozone attack on the stressed rubber. The process resembled the slow relaxation of a stretched film of a highly viscous liquid under the action of surface forces. The rate of the network formation was generally proportional to the oxidation resistance of the rubber. The significance of these observations is discussed in reference to the practice of cyclizing rubber surfaces as a pretreatment for adhesive bonding.
Author (GRA)

N77-28311# Naval Surface Weapons Center, White Oak, Md.
TORSIONAL PENDULUM STUDY ON SEVERAL RUBBER COMPOUNDS
G. F. Lee 4 Jan. 1977 27 p
(AD-A038735; NSWC/WOL/TR-76-144) Avail: NTIS HC A03/MF A01 CSCL 11/10

The goal of this investigation was to determine the shear properties on various rubber compounds using a low frequency (approximately equal to 1 Hz) measurement - torsional pendulum (TP) - to determine the damping and modulus as a function of temperature (-175 to 80 C). By applying WLF shift the damping and modulus were presented as a function of frequency (1 to 100 kHz, 10 C). From this data, the shear sound speed and absorption were calculated. From this investigation the rubber compounds are characterized as follows: the glass transition temperatures were found to be in a relative narrow range between -45 and -33 C. By changing the formulation the damping varied by a factor of 6, the modulus changed as much as a factor of A 330, the sound speed varied by a factor of 16, and finally, the absorption changed by a factor of 10, as a function of frequency. The TP is a good method for determining the acoustic properties of rubber compounds provided the WLF shift constants are known. GRA

N77-28312# Pennsylvania State Univ., University Park. Petroleum Refining Lab.
FLUIDS, LUBRICANTS, FUELS AND RELATED MATERIALS Final Report, 1 May 1975 - 30 Apr. 1976
E. Erwin Klaus, Elmer J. Tewksbury, Emilio Cvitkovic, Joseph Maskew, and Stephen Hsu Wright-Patterson AFB, Ohio AFML Nov. 1976 168 p refs
(Contract F33615-73-C-5101; AF Proj. 7343)
(AD-A038066; AFML-TR-74-201-Pt-3) Avail: NTIS HC A08/MF A01 CSCL 11/8

A new microtest for evaluation of the oxidative and thermal degradation of fluids and lubricants has been developed. This test, in conjunction with gel permeation chromatography, promises to provide a means for rapid determination of the extent of oxidative and additive degradation. The effects of base fluid viscosity, mean pore diameter, and additive concentration on the formation of thin films on a capillary wall are examined. Mean pore diameters of 0.2-1.2 microns are used. These thin films are shown to have properties different than those of the bulk fluid. Competition of additives is shown to have an effect on the formation and thickness of these surface films. Cellulose type filters as well as metal filters are used to provide the microcapillaries. Techniques which allow the accurate determination of wear debris from the four-ball wear tester have been developed. Preferential and competitive adsorption of polar species on the metal surface and the subsequent chemical reactions are shown to be the key process in boundary lubrication. Commercial phosphorus-containing antiwear additives are investigated using the experimental technique developed in this study. Surface temperatures are demonstrated to be a key parameter in boundary surface interactions both physically and chemically. GRA

N77-28313# Army Materials Research Agency, Watertown, Mass.
EVALUATION OF POLYPHENYLQUINOXALINES DERIVED FROM AN INEXPENSIVE TETRAKETONE MONOMER Final Report
Stanley E. Wentworth and Michael J. Humora Mar. 1977 14 p
(AD-A038839; AMMRC-TR-77-7) Avail: NTIS HC A02/MF A01 CSCL 07/3

Polyphenylquinoxalines (PPQ's), which are superior high-temperature-resistant resins, have long been considered too costly for most aerospace applications. This is principally due to the high cost of the tetraketone monomers from which they are prepared. A recently developed alternate synthesis of these tetraketones promises to dramatically lower their cost. A PPQ has been prepared from one of these low-cost tetraketones and a series of comparisons made with the analogous PPQ derived from the conventionally prepared tetraketone. It is concluded that the PPQ derived from the tetraketone prepared via this new route is essentially equivalent to the PPQ obtained from the original monomer. Thus, the new synthesis has not introduced any impurities peculiar to it which have a deleterious effect on the resultant polymer. Author (GRA)

N77-28314# Texas Technological Univ., Lubbock. Dept. of Chemical Engineering.
DETERMINATION OF SOLVENTS FOR THERMALLY STABLE AROMATIC HETEROCYCLIC POLYMERS Final Report, Dec. 1974 - Nov. 1975
David C. Bonner Apr. 1976 76 p refs
(Contract F33615-75-C-5072)
(AD-A038401; AFML-TR-76-5123) Avail: NTIS HC A05/MF A01 CSCL 11/11

Developed and tested was a relatively rapid experimental procedure to screen and rank potential solvents for aromatic, heterocyclic polymers. Polymers utilized in the study were meta-phenylene PBI, PDIAB, PBO, and ATQ. Quantitative criteria have been developed for using gas chromatographic data to determine solvents for aromatic, heterocyclic polymers. The criteria require gas chromatographic data and polar and hydrogen-bonding solubility parameters for the solvents of interest. Author (GRA)

N77-28315# North Carolina State Univ., Raleigh. Dept. of Chemical Engineering.
TRANSITIONS IN POLY(VINYL FLUORIDE) AND POLY (VINYLIDENE FLUORIDE)
M. Fujii, V. Stannett, and H. B. Hopfenberg Apr. 1977 15 p refs
(Contract N00014-75-C-0629)
(AD-A038819; TR-3) Avail: NTIS HC A02/MF A01 CSCL 07/3

The temperature dependence of the argon permeability and diffusion coefficients in poly(vinyl fluoride) and poly(vinylidene fluoride) was determined experimentally. Two transitions were revealed as slope discontinuities in the Arrhenius plots of the transport parameters for argon in poly(vinyl fluoride). Only one transition however was observed in poly(vinylidene fluoride). A second transition reported in the literature using other techniques was below -30 C, the lowest temperature conveniently obtained in the existing experimental apparatus. The results are consistent with dilatometry data also reported in this paper and with literature values. Author (GRA)

N77-28316# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.
IMPACT BEHAVIOR OF POLYMERIC MATRIX COMPOSITE MATERIALS Final Technical Report, Mar. 1975 - Jul. 1976
Pei Chi Chou and Richard W. Mortimer Wright-Patterson AFB, Ohio AFML Dec. 1976 93 p refs
(Contract F33615-73-C-5102)
(AD-A038188; AFML-TR-76-242) Avail: NTIS HC A05/MF A01 CSCL 21/5

The problem of foreign-object impacts of jet-engine fan-blades is studied by two approaches. First, the overall response of a blade-like structure is predicted by a one-degree-of-freedom impact model in which the blade is treated as a cantilever beam or plate. Design curves are presented for finding the peak stress levels in many impact situations, including both hard and soft (fluid) impactors. Second, the local response to an edge impact is studied using a finite-difference method based on anisotropic constitutive relations. In addition, experiments have been conducted to compare with each method. Author (GRA)

N77-28317# General Electric Co., Schenectady, N.Y.
BASIC RESEARCH ON TECHNOLOGY DEVELOPMENT FOR SINTERED CERAMICS Final Technical Report, 1 Aug. 1975 - 31 Jul. 1976
Charles D. Greskovich, Svante Prochazka, and Joseph H. Rosolowski Nov. 1976 97 p refs
(Contract F33615-76-C-5033; ARPA Order 3058)
(AD-A038071; SRD-76-151; AFML-TR-76-179) Avail: NTIS HC A05/MF A01 CSCL 11/2

Pure silicon nitride powder is prepared by calcination of the reaction product obtained from SiH4 and anhydrous NH3 at 600 C and above. It is amorphous up to 1480 degrees and converts to alpha-Si3N4 above this temperature. Hot-pressing at 5 GPa at 1500 C and above yields dense specimens of near theoretical density and up to 3,000 kg/sq m Knoop microhardness (200 g load). Annealing at 1750 C does not induce grain growth. Hot-pressing under nominal conditions up to 1800 C does not bring about appreciable densification. Exposure of compacts to various atmospheres at 1400-1800 C causes specific surface area reduction and weight loss but no densification. The weight loss is related to specific surface area. Both weight loss and coarsening is related to thermal decomposition of Si3N4. Selected non-oxide additions, on the 1-2% level, permit the attainment of nearly theoretical density in Si3N4 by hot-pressing at 1750-1800 C and sintering at 1800-2000 C. Sintering was done under 8 MPa nitrogen pressure. The dense specimens are composed of beta-Si3N4 grains having a larger aspect ratio as the sintering temperature is increased. Author (GRA)

N77-28318# Stanford Research Inst., Menlo Park, Calif.
CHARACTERIZATION OF THE DYNAMIC BEHAVIOR OF POROUS SOLIDS. VOLUME 7: MICROSTRUCTURAL CHARACTERIZATION OF SEVERAL POROUS CERAMICS AND POROUS BERYLLIUM Final Report, 14 Jan. 1974 - 31 Jan. 1976
Donald A. Shockey, M. J. Ginsberg, J. P. Wilhelm, and D. R. Curran Mar. 1976 39 p
(Contract DNA001-74-C-0150)
(AD-A038685; DNA-3961F-7) Avail: NTIS HC A03/MF A01 CSCL 11/2

Porous sintered alumina, flame sprayed alumina, plasma sprayed aluminum titanate, plasma sprayed hafnium titanate, and plasma sprayed distended beryllium were used in the high explosive, gas gun and electron beam experiments reported in Volumes 4, 5, and 6 in this series. This report, Volume 7, describes the fabrication process, the microstructural characteristics, and the important chemical, physical and mechanical properties of each material. Author (GRA)

N77-28319# Naval Research Lab., Washington, D. C. Polymeric Materials Branch.
SILICON-PHTHALOCYANINE SILOXANE POLYMERS: SYNTHESIS AND (1)H NUCLEAR MAGNETIC RESONANCE STUDY
J. B. Davidson and K. J. Wynne 1 Mar. 1977 37 p refs
Prepared in cooperation with Case Western Reserve Univ.
(Contract N00014-75-C-0693; NR Proj. 356-590)
(AD-A036274; TR-1) Avail: NTIS HC A03/MF A01 CSCL 07/2

The reaction of silicon phthalocyanine (PcSi) disilanols with bis(ureido)dimethylsilane and bis(ureido)siloxanes yields blue PcSi-siloxane polymers of the general formula (PcSiOSiMePh (OSiMe2)n OSiMePhO), where Me=methyl, Ph=phenyl and n=2(IV), 3(V) and 4(VI). Reactions which lead to polymers V and VI have been studied via nuclear magnetic resonance spectroscopy. The dominant shielding effect of the Pc ring which causes clear separation of methyl groups in adjacent siloxane chains facilitated this study. Polymers IV and V have been prepared from PcSi(OSiMePhOH)2 and appropriate bis(ureido)-siloxanes. Polymer V was considerably more soluble in organic solvents than polymer IV. Polymer V melted at ca. 65-70 degrees, while polymer IV softened at ca. 100 degrees (Tg) but did not melt. Molecular weights for IV(1400) and V (1200) have been estimated from their nmr spectra.
Author (GRA)

N77-28320# Magnetic Engineering Associates, Cambridge, Mass.
REMOVAL OF WEAR PARTICLES FROM OILS USING HIGH GRADIENT MAGNETIC SEPARATION
William G. Langton Jan. 1977 60 p refs
(Contract N00014-75-C-1166)
(AD-A036270) Avail: NTIS HC A04/MF A01 CSCL 11/8

Information concerning the efficiency with which small ferromagnetic wear particles may be removed from lubricating oils by high gradient magnetic separation, and to determine the dependence of that efficiency upon system parameters such as magnetic field strength and flow rate. An attempt has also been made to provide evidence that lubricant properties are improved by high gradient magnetic filtering in accelerated wear situations. Although the results of such tests have been positive, they must be considered tentative until more comprehensive tests under normal wear conditions have been carried out. Tests of this kind involving normal wear in a Diesel engine are now being planned. Quantitative determinations of the efficiency of high gradient magnetic filtering of oil were made using clean oil that had been seeded with micron size iron spheres. These determinations were later repeated and fortified by experiments in which oil was circulated through a loop containing both a filter and a wear particle generator in the form of a Falex lubricant test machine. GRA

N77-28321# National Academy of Sciences - National Research Council, Washington, D. C. Board on Science and Technology for International Development.
GUAYULE: AN ALTERNATIVE SOURCE OF NATURAL RUBBER Final Report
Mar. 1977 91 p refs
(Contract AID/CSD-2584)
(PB-264170/2; CIR/BOSTID-77/22) Avail: NTIS HC A05/MF A01 CSCL 11J

The report describes a little-known bush that grows wild in deserts of North America and produces a rubber virtually identical to that of the rubber tree. It recommends funding for guayule development. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N77-28322*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ALTERNATE AIRCRAFT FUELS: PROSPECTS AND OPERATIONAL IMPLICATIONS
Robert D. Witcofski May 1977 44 p refs
(NASA-TM-X-74030) Avail: NTIS HC A03/MF A01 CSCL 21D

The potential use of coal-derived aviation fuels was assessed. The studies addressed the prices and thermal efficiencies associated with the production of coal-derived aviation kerosene, liquid methane and liquid hydrogen and the air terminal

requirements and subsonic transport performance when utilizing liquid hydrogen. The fuel production studies indicated that liquid methane can be produced at a lower price and with a higher thermal efficiency than aviation kerosene or liquid hydrogen. Ground facilities of liquefaction, storage, distribution and refueling of liquid hydrogen fueled aircraft at airports appear technically feasibile. The aircraft studies indicate modest onboard energy savings for hydrogen compared to conventional fuels. Liquid hydrogen was found to be superior to both aviation kerosene and liquid methane from the standpoint of aircraft engine emissions. Author

N77-28323# California Univ., Livermore. Lawrence Livermore Lab.

BIOSOLAR PRODUCTION OF FUELS FROM ALGAE

T. W. Jeffries, P. H. Moulthrop, H. Timourian, R. L. Ward, and B. J. Berger 15 Nov. 1976 41 p refs

(Contract W-7405-eng-48)

(UCRL-52177) Avail: NTIS HC A03/MF A01

A design concept is described for the production of methane, hydrogen, and ammonia using solar energy. Filamentous, nitrogen fixing blue-green algae are employed as a source of biomass for methane and ammonia generation by anaerobic digestion and as a biological catalyst for the photoproduction of hydrogen from water. The resources needed, biomass production and harvest, anaerobic digester, the process of biophotolysis, and product separation are discussed. The environmental and genetic modifications possible to increase biomass production are indicated. Preliminary cost estimates are made for methane and hydrogen production. It is concluded that biosynthetic methane is not economically competitive with that derived from coal gasification, but that hydrogen production offers a viable long range prospect. Author (ERA)

N77-28324# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.

GUIDE FOR THE CONVERSION TO AND MAINTENANCE OF HYDROGEN-FUELED, SPARK-IGNITED ENGINES

F. B. Simpson, J. H. Lofthouse, D. R. Swope, and D. L. Henriksen Jan. 1977 31 p refs

(Contract EY-76-C-07-1570)

(TREE-1036) Avail: NTIS HC A03/MF A01

A guide to one approach to the conversion of an internal combustion engine to hydrogen fuel is presented. Safety aspects, conversion, operation and maintenance of the engine are also included. ERA

N77-28325# Exxon Research and Engineering Co., Linden, N.J. Government Research Lab.

EVALUATION OF METHODS TO PRODUCE AVIATION TURBINE FUELS FROM SYNTHETIC CRUDE OILS, PHASE 2, VOLUME 2 Final Report, 24 Jan. 1975 - 24 Apr. 1976

Charles D. Kalfadelis Wright-Patterson AFB, Ohio AFAPL May 1976 365 p

(Contract F33615-74-C-2036)

(AD-A036190; EXXON/GRU.2PEA.76-Vol-2; AFAPL-TR-75-10-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 07/1

An experimental pilot-plant program is described which has demonstrated that specification JP-4 wide-cut type and Jet A narrow-cut type aviation turbine fuels may be produced from domestic shale oils. Three shale oils and two coal-derived liquids were evaluated in the program, which is the second phase in a three phase overall program. The original whole crude samples were assayed and fractionated to yield kerosene-boiling-range feedstocks for catalytic hydrotreatment experiments. Three levels of hydrotreatment severity were investigated, using nickel-molybdenum and cobalt-molybdenum catalysts. Hydrotreated products were fractionated and reblended to yield finished fuels. The experimentally obtained process and analytical information will be used in the third phase of the program to provide a basis for an engineering and and economic evaluation of the effect of the use of synthetic crude oil in a refinery processing both petroleum and synthetic crude. Author (GRA)

N77-28326# Naval Air Propulsion Test Center, Trenton, N.J. Propulsion Technology and Project Engineering Dept.

OPERATING CHARACTERISTICS OF A NON-IONIZING ELECTROSTATIC COALESCER/PRECIPITATOR

J. Flomen May 1976 19 p refs

(AD-A036225; NAPTC-PE-86) Avail: NTIS HC A02/MF A01 CSCL 13/11

The latest modification of an electrostatic precipitator was evaluated for its ability to remove water from jet fuel. Satisfactory operation was obtained for water concentration up to 50 ppm with deteriorating performance at higher water concentrations. Author (GRA)

N77-28327# Dartmouth Coll., Hanover, N.H. Thayer School of Engineering.

LONG-TERM NATURAL RESOURCE AVAILABILITY: ENVIRONMENTAL AND POLITICAL IMPLICATIONS IN THE UNITED STATES Annual Report, 15 Sep. 1972 - 15 Sep. 1973

Roger F. Naill 1973 75 p refs

(Grant NSF GI-34808)

(PB-265762/5; DSD-9; NSF/RA/N-73-271; AR-1) Avail: NTIS HC A04/MF A01 CSCL 21D

A summary of six projects that use computer simulation models to explore the potential role of coal as a transition fuel is presented. A dynamic simulation model that explores the interaction between energy availability and economic growth during the transition from fossil fuel energy sources to ultimate energy sources was developed. Major areas where policy tests significantly affect the transition to coal were identified. The environmental standards study analyzes the nature of the constraint on increased coal use imposed by the problem of air pollution by sulfur dioxide emissions. An analysis on energy imports and international politics indicated the sensitivity of the study model to an increased rate of imports and its inability to cope with the strains generated by increased reliance on external sources. GRA

N77-28328# Federal Power Commission, Washington, D. C. Bureau of Natural Gas.

NATIONAL GAS FLOW PATTERNS 1975: GEOGRAPHIC FLOW PATTERNS AND INTERCOMPANY RELATIONSHIPS

Feb. 1977 659 p

(PB-266111/4) Avail: NTIS HC A99/MF A01 CSCL 21D

The interrelationships existing in 1975 among the U.S. gas supply areas, the gas market areas, and the interstate natural gas pipeline network are examined. The volume of production out of each supply areas which goes into interstate pipelines; the volume going intrastate only; the major gas transfers between interstate pipelines; and the volume each pipeline delivers to each state for final consumption are given. Estimates of the gas volumes which flowed between any combination of areas and were directly connected are included. GRA

N77-28329# Stanford Research Inst., Menlo Park, Calif.

THE HYDROGEN ECONOMY: A PRELIMINARY TECHNOLOGY ASSESSMENT Final Report

Edward M. Dickson, John W. Ryan, and Marilyn H. Smulyan Feb. 1976 407 p refs

(Grant NSF ERP-73-02706; SRI Proj. EGU-2836)

(PB-266607/1; NSF/RA-760491) Avail: NTIS HC A18/MF A01 CSCL 21D

Hydrogen must be manufactured from basic energy resources since it is not a naturally occurring energy form. The question of the feasibility of the use of hydrogen as a fuel was studied. Although it is generally believed that hydrogen might soon become less expensive than petroleum, competition among fuels in the energy marketplace and the need to derive hydrogen from other energy sources will insure that hydrogen does not become less expensive than alternatives for a very long time. Transitions involving change in basic infrastructure technologies, systems, and institutions are difficult to effect because new, embryonic systems must compete with established systems, often at a price disadvantage. The following are included: (1) summary and recommendations; (2) technology assessment and energy in the future; (3) hydrogen technologies, present and projected; (4) competing and complementing technologies, present and projected; (5) economics of hydrogen; (6) transition to a hydrogen economy; and (7) consequences of a hydrogen economy. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N77-28330*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

BOILING INCIPIENCE AND CONVECTIVE BOILING OF NEON AND NITROGEN

S. S. Papell and R. C. Hendricks Aug. 1977 18 p refs Presented at the joint meeting of the Cryog. Eng. Conf. and the Intern. Cryog. Mater. Conf., Boulder, Colo., 2-5 Aug. 1977
(NASA-TM-X-73615; E-9099) Avail: NTIS HC A02/MF A01 CSCL 20L

Forced convection and subcooled boiling heat transfer data for liquid nitrogen and liquid neon were obtained in support of a design study for a 30 tesla cryomagnet cooled by forced convection of liquid neon. The cryogen data obtained over a range of system pressures, fluid flow rates, and applied heat fluxes were used to develop correlations for predicting boiling incipience and convective boiling heat transfer coefficients in uniformly heated flow channels. The accuracy of the correlating equations was then evaluated. A technique was also developed to calculate the position of boiling incipience in a uniformly heated flow channel. Comparisons made with the experimental data showed a prediction accuracy of + or - 15 percent. Author

N77-28331*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF ICE CONTAMINATION OF LIQUID-NITROGEN DROPS IN FILM BOILING

G. J. Schoessow (Florida Univ., Gainesville), C. E. Chmielewski (Indiana Public Service Co., Plainfield), and K. J. Baumeister Aug. 1977 12 p refs Presented at 1977 Cryogenic Engr. Conf., Boulder, Colo., 2-5 Aug. 1977; sponsored by NBS
(NASA-TM-73704; E-9243) Avail: NTIS HC A02/MF A01 CSCL 20L

Previously reported vaporization time data of liquid nitrogen drops in film boiling on a flat plate are about 30 percent shorter than predicted from standard laminar film boiling theory. This theory, however, had been found to successfully correlate the data for conventional fluids such as water, ethanol, benzene, or carbon tetrachloride. Experimental evidence that some of the discrepancy for cryogenic fluids results from ice contamination due to condensation is presented. The data indicate a fairly linear decrease in droplet evaporation time with the diameter of the ice crystal residue. After correcting the raw data for ice contamination along with convection, a comparison of theory with experiment shows good agreement. Author

N77-28332# Toronto Univ. (Ontario).

AN INVESTIGATION OF THE ROLL STIFFNESS CHARACTERISTICS OF THREE FLEXIBLE SKIRTED CUSHION SYSTEMS

P. A. Sullivan, M. J. Hinchey, and R. G. Elaney Mar. 1977 102 p refs Sponsored by the Transportation Development Agency
(UTIAS-213; CN-ISSN-0082-5255) Avail: NTIS HC A06/MF A02

Experimental data on the roll stiffness characteristics of three flexible skirted air cushion systems are reported. The systems examined were: (1) an open loop and segment system resembling HDL designs; (2) a multicell system resembling early Bertin/SEDAM designs; and (3) a recently developed multicell known as a Flexicell. The results show that, whereas the loop and segment skirt behaves in a relatively straightforward manner, the multicell systems are subject to certain phenomena which could have important consequences in practice. The most noticeable of these phenomena is a loss of restoring ability or hysteresis in the roll up portion of a roll down-roll up cycle. For the Bertin type multicell this hysteresis is sometimes so large as to completely eliminate the restoring moment of the cushion. The available evidence indicates that the hysteresis is, in some cases, associated with a buckling failure of the air cells which generate the roll stiffness. Author

N77-28333# Energy Research and Development Administration, Washington, D.C.

HIGH VACUUM ADSORPTION PUMPS

A. I. Volchkevich 1976 170 p refs Transl. into ENGLISH of the Russian book Moscow, Mashinostroyeniye, 1973
(ERDA-TR-224) Avail: NTIS HC A08/MF A01

The nature of adsorption interaction and the fundamental equations of adsorption isotherms are examined, and brief characteristics of the adsorbents used in adsorption pumps are given. The kinetic equations of the most characteristic adsorption processes occurring under actual operating conditions of adsorption pumps are generalized. A survey of methods of experimental investigation of the equilibrium and kinetics of gas adsorption processes is presented. Experimental data on isotherms of gas adsorption on microporous adsorbents that make it possible to calculate the limiting pump pressure are correlated. General relationships governing the change of pressure in an adsorption pump to which a gas is supplied at a constant rate are discussed in detail; this makes it possible to select the most effective adsorbent and calculate the speed characteristic of a pump in a dynamic vacuum system. The most efficient pump designs are presented, and recommendations concerning their operation are given. ERA

N77-28334# Energy Research and Development Administration, Washington, D.C.

TECHNOLOGY OF FABRICATION OF VACUUM EQUIPMENT

A. V. Balitskii 1976 372 p refs Transl. into ENGLISH of the Russian book Moscow, Energiya, 1974
(ERDA-TR-239) Avail: NTIS HC A16/MF A01

Fabrication and sealing materials most commonly used in vacuum technology are described and information on their gas permeability and gas evolution in a vacuum is given. The conditions for obtaining weld and solder joints for high and ultrahigh vacuum are indicated. The formulas of certain fluxes are given. Various types of vacuum seals are analyzed, and some reference data on them are presented. The principal methods of testing for vacuum tightness are briefly described. The information is addressed to qualified workers, skilled workmen, and production engineers working in various industrial sectors and dealing with the manufacture and operation of high vacuum installations. ERA

N77-28335# National Bureau of Standards, Washington, D. C. Engineering Mechanics Section.

INTERLABORATORY COMPARISON OF FORCE CALIBRATIONS USING ASTM METHOD E74-74, PHASE 1 Summary Report, 1 Jun. 1974 - 1 Aug. 1975

R. W. Peterson and R. L. Bloss Aug. 1976 36 p Sponsored by Dept. of Commerce.
(PB-265110/7; NBSIR-76-1145) Avail: NTIS HC A03/MF A01 CSCL 14B

An intercomparison of force calibrations is presented. Results obtained show that the provisions of ASTM Method E74-74, 'Standard Methods of Calibration of Force-Measuring Instruments for Verifying the Load Indication of Testing Machines' can be met by a variety of calibration laboratories. In general, uncertainties computed from the data are of the magnitude expected based upon the NBS results. An important by-product of the program is the mechanism for self-evaluation by each laboratory of its own force calibration. GRA

N77-28336# Bendix Corp., Baltimore, Md. Environmental and Process Instruments Div.

FEASIBILITY STUDY OF ELECTRIC SHOCK PREVENTION, PHASE 3 Report, Jun. 1975 - Jul. 1976

Gorden R. Sima Sep. 1976 74 p ref
(Contract DI-BM-J0-357115)
(PB-266073/6; BM-OFR-72-77) Avail: NTIS HC A04/MF A01 CSCL 13L

Feasibility studies, design and fabrication of a prototype hand held test instrument and a machine mounted test instrument for measurement of electrical shock hazards of mining machines are reported. The report presents the proposed and detailed design of the hand held test instrument, and the machine mounted test instrument. Theory of operation of each instrument is discussed and includes the operating parameters. GRA

N77-28337# Lease AFEX, Inc., Raleigh, N. C.
DEVELOPMENT, INSTALLATION, AND TESTING SERVICES FOR AN AUTOMATIC, POINT TYPE THERMAL SENSOR, FIRE PROTECTION SYSTEM ON A MINING DOZER Final Report
William D. Lease Aug. 1976 18 p
(Contract DI-BM-S0-360490)
(PB-266075/1; BM-OFR-71-77) Avail: NTIS HC A02/MF A01 CSCL 13L

The standard design of an automatic fire protection system used in the past in logging equipment, was modified by improving the actuation device. The resultant system was installed on a crawler tractor for coal mine operations. The system was tested by fire simulation on the dozer, and continued to operate successfully after four months of in-mine endurance testing. GRA

N77-28338# National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.
STUDY OF THE NATIONAL MEASUREMENT SYSTEM Final Summary Report, 1972 - 1975
Raymond C. Sangster Dec. 1976 49 p refs
(PB-265622/1; NBSIR-75-925) Avail: NTIS HC A03/MF A01 CSCL 14B

The structural model of the system has five levels: conceptual system, basic technical infrastructure, realized measurement capabilities, institutional dissemination and enforcement network, and end-use measurement activities. Transactions in the system have been described in a matrix format; indicative cost-benefit analyses are also described. Measurement sectors covered by 24 microstudies include time and frequency; mechanical, thermal, electrical, electromagnetic acoustic, and optical quantities; and ionizing radiation. Major system trends are toward increased complexity and integration, improved quality control and information resources, automation, metrication, and consolidation of the recent scientific revolution in metrology. GRA

N77-28339# National Bureau of Standards, Washington, D. C. Inst. for Applied Technology.
RECOMMENDED PRACTICE FOR THE USE OF METRIC (SI) UNITS IN BUILDING DESIGN AND CONSTRUCTION Interim Report
Hans J. Milton Apr. 1977 51 p refs
(PB-265803/7; NBS-TN-938) Avail: NTIS HC A04/MF A01 CSCL 13M

The comprehensive set of recommendations includes descriptive material dealing with the structure of the International System of Units (SI); rules and recommendations for the presentation of SI units and symbols, and of numerical values associated with SI; a set of tables showing working units and typical applications for SI units in building design and construction; and a section dealing with special considerations in the selection and use of SI units in design and construction. Appendices show conversion factors for the most common units. GRA

N77-28340# National Bureau of Standards, Washington, D. C. Office of International Relations.
REPORT TO AID ON AN NBS/AID WORKSHOP ON STANDARDIZATION AND MEASUREMENT SERVICES Final Report
H. Steffen Peiser, Joan Cornish, and Charles C. Raley Mar. 1977 112 p Workshop held at Gaithersburg, Md., 20 Sep. - 3 Oct. 1975
(Contract PASA-TA(CE)-5-71)
(PB-265719/5; NBSIR-76-1152) Avail: NTIS HC A06/MF A01 CSCL 14B

Standards officials of industrializing nations are given insight into the standards and measurement systems of the United States and the role of the National Bureau of Standards, so that these officials might consider what parts of the U.S. system might usefully be adapted to conditions in their home countries. An exchange of standardization experience in each of the participant's countries was presented by delivered papers which are reproduced here. GRA

N77-28341# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
MULTIDISCIPLINARY ACCIDENT INVESTIGATION DATA FILE, 1975 Final Report, 18 Apr. 1975 - 17 Apr. 1976
Joseph C. Marsh, IV, Marion J. Compton, and John A. Green Mar. 1977 80 p
(Contract DOT-HS-5-01134)
(PB-265715/3; UM-HSRI-76-7; DOT-HS-802-291) Avail: NTIS HC A05/MF A01 CSCL 13L

In-depth accident reports are edited and processed for computer storage and retrieval. Accident investigation case studies were edited and formatted into the Collision Performance and Injury Report (CPIR) revision 3 data sets. In addition, new data sets implemented from the damage analysis supplement, occupant supplement, and Air Cushion Restraint System (ACRS) supplement were created. The report describes the production aspects of the program, the data editing and quality control protocol used in case editing, and the contents of the data files that are constructed from the CPIR revision 3 and the ACRS supplements. An index of Dept. of Transportation-Highway Safety publication numbers is also included. GRA

N77-28342# Iowa State Univ. of Science and Technology, Ames. Dept. of Chemical Engineering and Nuclear Engineering.
SCALE UP STUDY ON SEVERAL ENZYMATIC PROCESSES FOR INDUSTRIAL APPLICATION Final Report
Peter J. Reilly Dec. 1976 176 p refs
(Grant NSF APR-73-07783)
(PB-266648/5; ISU-ERI-AMES-77/76; NSF/RA-760488) Avail: NTIS HC A09/MF A01 CSCL 07C

The feasibility of using glucoamylase immobilized on porous silica in the production of glucose from dextrin was studied; by means of laboratory investigation and a pilot plant setup the effects of this included theoretical examination of pore diffusion on enzyme selectivity, activity, and stability. Also investigated was the sue and optimization of a two-enzyme mixed immobilized reactor system of glucoamylase and glucose isomerase to produce fructose from either maltose or dextrin. The production and purification of dextransucrase and the immobilization and characterization of dextransucrase, beta-amylase, and mutaritase were accomplished, to determine a possible role for each in monosaccharide production. GRA

N77-28343# Minnesota Univ., Minneapolis.
METRIC TRANSITION IN THE UNITED STATES
John E. Wertz Dec. 1976 234 p
(Grant NSF GI-40445)
(PB-266868/9; NSF/RA-760492) Avail: NTIS HC A11/MF A01 CSCL 14B

The possible consequences of decisions to substitute the international System of Units (SI), or metric system, for those of the customary system of 'English' system, in the private and public sectors are discussed. The objectives of the project were: to investigate the consequences of independent conversions; to examine the motivations and limitations of voluntary conversion; to examine the issues apparent in domestic conversion and those in recent or ongoing foreign conversions; to identify major impediments to conversion; to identify options for dealing with the major metric issues in the public and the private sectors; and to identify mechanisms for overcoming major impediments and minimizing public apprehension. GRA

N77-28344# National Bureau of Standards, Washington, D. C. Center for Building Technology.
METRICATION AND DIMENSIONAL COORDINATION: A SELECTED BIBLIOGRAPHY Final Report
Roy E. Clark and Candace L. Roat Apr. 1977 36 p refs
(PB-266569/3; NBS-SP-45; LC-76-608345) Avail: NTIS HC A03/MF A01 CSCL 14B

Construction industry consideration and resolution of metrication decisions are aided by providing a guide to the best available sources relevant to the issues. GRA

N77-28345# National Bureau of Standards, Washington, D. C. Inst. for Basic Standards.
MEASUREMENT ASSURANCE Final Report
J. M. Cameron Apr. 1977 16 p refs
(PB-266238/5; NBSIR-77-1240) Avail: NTIS HC A02/MF A01 CSCL 14B

The factors involved in achieving measurement assurance,

beginning with the base line which serves as a standard of reference, the determination of the uncertainty relative to this basis, and the need for control of the measurement process to assure the continuing validity of the accepted process parameters are discussed. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N77-28346*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
WIDEBAND HETERODYNE RECEIVER FOR LASER COMMUNICATION SYSTEM Patent
Theodore Flattau (Cutler-Hamner Inc., Melville, N.Y.), Ronald Albert Lange (Cutler-Hamner Inc., Melville, N.Y.), Bernard Mellars (Cutler-Hamner Inc., Melville, N.Y.), Joseph Peyton (Cutler-Hamner Inc., Melville, N.Y.), and John Martin Wolczok, inventors (to NASA) (Cutler-Hamner Inc., Melville, N.Y.) Issued 5 Jul. 1977 11 p Filed 18 Mar. 1976 Supersedes N76-20466 (14 - 11, p 1391) Sponsored by NASA
(NASA-Case-GSC-12053-1; US-Patent-4,033,882; US-Patent-Appl-SN-667930; US-Patent-Class-250-199; US-Patent-Class-250-238) Avail: US Patent Office CSCL 17B

A heterodyne receiver for laser communication is described which includes a front end having a cooled photomixer contained in a hermetically sealed spaced quality housing designed for wide bandwidth transmission. The photomixer is coupled through a wideband preamplifier to the receiver back end which includes a frequency tracking network and demodulating equipment. The receiver is capable of tracking a Doppler frequency shift of 750 MHz, positive or negative, and has an instantaneous intermediate frequency information bandwidth of 400 MHz. The receiver system is also capable of operating over a wide temperature range and is designed to be suitable for use in outer space communication. Official Gazette of the U.S. Patent Office

N77-28347 New Hampshire Univ., Durham.
NONLINEAR ANALOG COMPUTATION AND MULTIFUNCTION GENERATION WITH NONLINEAR PULSE WIDTH MODULATION Ph.D. Thesis
Joannes Nicolaas Mattheus DeJong 1976 233 p
Avail: Univ. Microfilms Order No. 77-3467

A method for function generation and nonlinear analog computation is described. The method is based on pulse width modulation with a periodic carrier signal that is not a sawtooth or triangular wave signal. Instead, the carrier signal wave forms are sinusoidal, exponential. If, for example, the carrier signal is a sine wave, then the average value of the output signal of the modulator is the arcsin function of the input modulating signal. Demodulation is done by feeding the pulse width modulated signal into an integrator which has a pulse width modulator in its feedback path. Dissert. Abstr.

N77-28348 California Univ., Los Angeles.
MULTIPLEXING TECHNIQUES FOR DATA TRANSMISSION OVER PACKET SWITCHED RADIO SYSTEMS Ph.D. Thesis
Michel Olivier Scholl 1976 248 p
Avail: Univ. Microfilms Order No. 77-1662

Alternating Priorities (AP), Round Robin (RR) and Random Order (RO) are introduced as methods for multiplexing a small number of buffered users, without control from a central station. In these access modes, the channel utilization is increased by allowing any user to steal the channel time assigned to a user who is idle (by sensing the carrier). These methods are effective when the number of users is not too large (less than 20) or when the propagation delay of the signal is small compared with the packet transmission time. Otherwise, a large overhead leads to a performance degradation. To reduce this degradation, a natural extension of AP, called Mini-slotted Alternating Priorities (MSAP) is considered which minimizes the overhead and performs better than existing techniques (such as Polling) for multiplexing a small number of buffered users over a single radio channel. Dissert. Abstr.

N77-28349 Princeton Univ., N. J.
ADPCM SYSTEMS WITH APPLICATIONS TO DIGITAL SIGNAL PROCESSING Ph.D. Thesis
Lawrence Howard Goldstein 1976 174 p
Avail: Univ. Microfilms Order No. 77-2146

A good approximate analysis of the mean-square quantization error introduced by the modulation of a Gaussian signal by ADPCM is presented. Theoretical predictions and computer simulation results are seen to agree over a broad range of operating conditions. A method is developed for computing the exact joint probability distribution function of quantization error and step-size in an ADPCM driven by a first-order Markov input sequence. The emphasis is on understanding the errors introduced by using an ADPCM system to modulate a given input signal. The problem of stability of an ADPCM system is considered from two viewpoints. Dissert. Abstr.

N77-28350 Purdue Univ., Lafayette, Ind.
INTERFERENCE POWER BALANCING FOR MULTIPLE ACCESS COMMUNICATION SYSTEMS Ph.D. Thesis
David Reed Peterson 1976 124 p
Avail: Univ. Microfilms Order No. 77-1759

The interference effects among the users of a multiple access communication system are studied. Avoidance and averaging signal designs are compared for three system configurations limited by interference. It is concluded that there may indeed be potential performance improvement available by balancing transmitter powers to achieve equal signal-to-interference ratios for all users of a communication system. Dissert. Abstr.

N77-28351 Kansas Univ., Lawrence.
AN APPLICATION OF DIGITAL INVERSE FILTERING TECHNIQUES TO AUTOMATIC SPEECH RECOGNITION Ph.D. Thesis
Stephen Vance Rowson 1976 225 p
Avail: Univ. Microfilms Order No. 77-2270

An automatic speech recognition system was trained to recognize the 26 letters of the English alphabet spoken in isolation. The system was later modified to handle words made up of one, two or three letters spoken in isolation, using a simple syntax rule to eliminate invalid combinations. The average recognition rate for this system was 77% correct with a vocabulary of 1,369 words. Through this study the advantage of combining several types of decision rules was clearly demonstrated. The effect of vocal tract length variation on computed word tract shape was determined, suggesting an indirect method for human vocal tract length measurement. The results indicate that vocal tract shape computed from inverse filter coefficients can be a useful technique for speech recognition. Dissert. Abstr.

N77-28352 Colorado Univ., Boulder.
THEORY AND APPLICATION OF THE FW-CW DOPPLER RADAR Ph.D. Thesis
Richard George Strauch 1976 111 p
Avail: Univ. Microfilms Order No. 77-3237

Examination of the signal obtained from consecutive sweeps of an FM-CW radar transmitter shows that the variation of signal phase between consecutive sweeps depends only on target velocity. The phase changes from sweep to sweep are analogous to those measured by coherent pulse Doppler radars; consequently the velocity measurement capabilities of an FM-CW Doppler radar are approximately the same as those of a pulse Doppler radar. The Doppler velocity spectrum is readily obtained for each range resolution cell for both types of radars. A data system that had been developed for a pulse Doppler radar was used to demonstrate the velocity measurement capabilities of an FM-CW Doppler radar with both hydrometeor scatterers and scattering from refractive-index fluctuations. Dissert. Abstr.

N77-28353 West Virginia Univ., Morgantown.
THREE-DIMENSIONAL VECTOR MODELING AND RESTORATION OF FLAT FINITE WAVE TANK RADIOMETRIC

MEASUREMENTS Ph.D. Thesis
William Maurice Truman 1976 237 p
Avail: Univ. Microfilms Order No. 77-2574

A three-dimensional Fourier transform analytical method describing the interaction between the water surface emitted radiation from a flat finite wave tank and antenna radiation characteristics is presented. The model has the capability of computing the antenna temperature response given the brightness temperature profile of the surrounding environment and/or to restore the brightness temperatures given the antenna response. The transform technique represents the scanning of the antenna mathematically as a correlation. Computation time is reduced by using the efficient and economical Fast Fourier transform algorithm. The system was analyzed with two different coordinate systems. A comparison of the results obtained with these two modelings verified the accuracy of the analysis. Dissert. Abstr.

N77-28354*# Motorola, Inc., Scottsdale, Ariz. Government Electronics Div.
MONOPULSE RECEIVER Final Report
Apr. 1977 81 p Prepared for JPL
(Contracts NAS7-100; JPL-954588)
(NASA-CR-153910) Avail: NTIS HC A05/MF A01 CSCL 17B

A time division multiplexing and a quadraphase combining dual channel system were analyzed, designed, and tested. Analyses performed include the following: (1) boresight error as a function of the error channel bandwidth; (2) error channel interference with the sum channel functions; (3) threshold performance; and (4) error channel crosstalk, linearity, and drift as a function of signal level, Doppler, and environment. Test results indicate that the time division multiplexing system meets the design goals of the program. However, careful selection and alignment of all gain controlled amplifiers are required along with temperature compensation of the angle channel gain. The quadraphase system crosstalk performance is comparatively poor (-15 dB) with respect to the -30 dB requirements and this consequently affects gain tracking performance. Gain tracking was found to be + or - 20 percent rather than the + or - 5 percent specification. Data for the two systems is compared and recommendations are presented. Author

N77-28355*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SHUTTLE ANTENNA RADOME TECHNOLOGY TEST PROGRAM. VOLUME 2: DEVELOPMENT OF S-BAND ANTENNA INTERFACE DESIGN Final Report
E. A. Kuhlman and L. C. Baranowski 15 Jun. 1977 191 p refs
(Contract NAS9-14722)
(NASA-CR-151470; MDC-E-1478-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 17B

The effects of the Thermal Protection Subsystem (TPS) contamination on the space shuttle orbiter S band quad antenna due to multiple mission buildup are discussed. A test fixture was designed, fabricated and exposed to ten cycles of simulated ground and flight environments. Radiation pattern and impedance tests were performed to measure the effects of the contaminates. The degradation in antenna performance was attributed to the silicone waterproofing in the TPS tiles rather than exposure to the contaminating sources used in the test program. Validation of the accuracy of an analytical thermal model is discussed. Thermal vacuum tests with a test fixture and a representative S band quad antenna were conducted to evaluate the predictions of the analytical thermal model for two orbital heating conditions and entry from each orbit. The results show that the accuracy of predicting the test fixture thermal responses is largely dependent on the ability to define the boundary and ambient conditions. When the test conditions were accurately included in the analytical model, the predictions were in excellent agreement with measurements. Author

N77-28356*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER VENUS MERCURY 1973 S/X-BAND EXPERIMENT
G. S. Levy 1 Jul. 1977 83 p refs
(Contract NAS7-100)
(NASA-CR-154105; JPL-Publ-77-17) Avail: NTIS HC A05/MF A01 CSCL 17B

The S/X-band experiment on the Mariner Venus/Mercury 1973 spacecraft constituted a unique opportunity to demonstrate the capability of an X-band downlink coherent with the normal S-band downlink. This was both a technological and scientific experiment, and the results indicated that it was successful in both cases. Analysis of the tracking data shows that the new S/X data type was capable of reducing the miss distance at the planet Mercury by 80% (post-processed data). The use of S/X electron content was demonstrated by comparison with Faraday rotation data. An X-band turnaround telemetry experiment showed the feasibility of a planetary X-band link. In the science area, the model atmospheric environment of Venus was refined. The ionosphere of the planet was measured to a higher accuracy than before, and the value of the dual-frequency link for measuring the scale size of turbulence was demonstrated. The estimate of the scale size was increased from 100 m to above 5 km. Author

N77-28357*# National Aeronautics and Space Administration. Pasadena Office, Calif.
CONICAL SCAN TRACKING SYSTEM EMPLOYING A LARGE ANTENNA Patent Application
John E. Ohlson and Macgregor S. Reid, inventors (to NASA) Filed 25 Jul. 1977 14 p
(Contract NAS7-100)
(NASA-Case-NPO-14009-1; US-Patent-Appl-SN-818917) Avail: NTIS HC A02/MF A01 CSCL 17I

A conical scan tracking system for spacecraft and radio sources employing a large antenna detects small sinusoidal variation in received power from a source that is off target with a frequency equal to a very low scan rate, an amplitude proportional to angular deviation of the source from the target, and a phase directly related to the direction the source is off target. The sinusoid is digitally correlated with inphase and out-of-phase (90 deg) scan sinusoids to obtain azimuth/elevation and hour angle/declination signals which are digitally integrated over exactly one scan period (e.g., 10 to 100 sec) to obtain correction signals for an antenna pointing subsystem. NASA

N77-28358*# National Aeronautics and Space Administration. Pasadena Office, Calif.
REDUNDANT RF SYSTEM FOR SPACE APPLICATIONS Patent Application
Charles W. Rook, inventor (to NASA) Filed 11 Jul. 1977 16 p
(Contract NAS7-100)
(NASA-Case-NPO-13955-1; NASA-Case-NPO-13956-1; NASA-Case-NPO-13957-1) Avail: NTIS HC A02/MF A01 CSCL 17B

An S-band radio frequency subsystem including two transmitters, two receivers and two antennas is described which is capable of connecting either transmitter or receiver to either antenna while permitting simultaneous operation of a transmitter and a receiver. Circulator switches provide selection of a specific transmitter and receiver for connection to either a high gain or low gain antenna. Transmitter output filters, receiver input filters, and diplexers are combined to prevent radiation or coupling of unwanted transmitter and receiver signals and to provide isolation. The filter elements are designed of constant diameter coaxial elements to meet demanding rejection, loss, power-handling and environmental characteristics. NASA

N77-28359# Los Alamos Scientific Lab., N. Mex.
THE 256-LINE, 2.8-ms FIELD DURATION TV CAMERA
George J. Yates and B. W. Noel Nov. 1976 22 p refs
(Contract W-7405-eng-36)
(LA-6407) Avail: NTIS HC A02/MF A01

A prototype 256-line, 2.8-ms field duration television camera was designed, built, and successfully field tested. It used an FPS vidicon tube to maintain good resolution while achieving the short field time. Details of design philosophy regarding the selection of the FPS vidicon, the parameters that affect the choice of the target material, the electronic design, and the calibration procedures are included. ERA

N77-28360# Laser Diode Labs., Inc., Metuchen, N. J.
INJECTION LASER DIODES FOR FIBER OPTIC COM-

MUNICATIONS Quarterly Report
Thomas E. Stockton 8 Dec. 1976 74 p
(Contract DAAB07-76-C-0040)
(AD-A038678; QR-1) Avail: NTIS HC A04/MF A01 CSCL 09/1

The design and fabrication of injection laser diodes for use in fiber optic communications is discussed with regard to material synthesis, chip configuration, and device assembly in manufacturing environment. The opto-electronic source is based on the GaAs-GaAlAs double heterojunction structure and consists of a parallel array of lasers formed by the application of triple stripe geometry to the surface of the epitaxial wafer. The monolithic triad of discrete lasing elements is mounted in a high frequency package which incorporates a high quality optical window. This report covers progress made during the first quarter of the program and outlines the major steps in the manufacturing sequence of the IL device. Author (GRA)

N77-28361# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A WIDEBAND WAVEGUIDE LENS
Andre R. Dion 2 Feb. 1977 23 p refs
(Contract F19628-76-C-0002)
(AD-A038541; TN-1977-8; ESD-TR-77-31) Avail: NTIS HC A02/MF A01 CSCL 09/1

A wideband compound waveguide lens which is the analog of the optical achromatic doublet is described and analyzed for its phase error characteristics. It is shown that the bandwidth of the compound lens varies from 40 to 20 percent for lens diameters varying from 20 to 100 wavelengths. This is an order of magnitude greater than the bandwidth heretofore obtainable with conventional waveguide lenses. Author (GRA)

N77-28362# Air Force Geophysics Lab., Hanscom AFB, Mass.
CONSIDERATIONS RELATIVE TO ADAPTING TRANSIT OBSERVATIONS TO PREDICTING RADAR RANGE CORRECTION Interim Report
Richard S. Allen 12 Jan. 1977 43 p refs
(AD-A038238; AFGL-TR-77-0004; AFGL-AFSG-357) Avail: NTIS HC A03/MF A01 CSCL 17/9

Uncertainties in the output data of SPACE TRACK radars caused by the variability of the ionosphere may be reduced 25 to 50 percent through the use of predictions of monthly median effects supplied by AWS/GWC. For some ADCOM missions this degree of correction is inadequate and a further reduction in error is necessary. This may be gained by using local measurements of ionospheric parameters, such as total electron content which may be obtained from TRANSIT satellite passes, to adapt the model ionosphere. An algorithm is proposed which uses data from sequential TRANSIT passes over a limited portion of the field of view of each ADCOM radar, to adapt the AWS/GWC prediction for the entire field of view. From the available TRANSIT data, it is estimated that the rms refraction error may be reduced by a factor of 3 to 4 by this technique. The principle problem which must be addressed by an adaptive technique is the inherent temporal and spatial variability of the ionosphere. The expected day-to-day variability is about 20 to 25 percent of the monthly median over a solar cycle for stations from the equator to auroral latitudes. In using TRANSIT data to adapt a local estimate of the ionospheric refraction correction, it is suggested that: 1. The adaptive techniques proposed, using TRANSIT data, should be tested against archive data. 2. Techniques using other sensors of the ionosphere, such as measurements of total electron content to synchronous satellites, should be developed and tested against archive data, and the results should be compared with the technique using TRANSIT data before a final method of correction is adapted.
Author (GRA)

N77-28363# GTE Sylvania, Inc., Mountain View, Calif. Electronics Systems Group-Western Div.
ADVANCED ARRAY DESIGN, TEST AND EVALUATION Final Technical Report, 1 May 1974 - 30 Jun. 1976
James E. Rice, Jr. Griffiss AFB, N.Y. RADC Jan. 1977 157 p refs
(Contracts F30602-74-C-0252; F30602-75-C-0287; AF Proj. 6512; AF Proj. 414L)
(AD-A038135; M1601; RADC-TR-77-25) Avail: NTIS HC A08/MF A01 CSCL 17/9

From 1 May 1974 to 30 June 1976, GTE Sylvania, Incorporated, Electronic Systems Group-Western Division, provided engineering field services in support of the RADC experimental HF FM/CW backscatter system at Dexter, New York. These services were primarily concerned with the design and development of a low side-lobe planar array, computer control of system parameters, and prediction of performance from precision measurements. This report discusses and details these efforts. Author (GRA)

N77-28364# Hughes Aircraft Co., Culver City, Calif. Antenna Dept.
CONFORMAL PHASED ARRAY BREADBOARD Final Report
Peter C. Bargeliotes, A. F. Seaton, Alfred T. Villeneuve, and Wolfgang H. Kummer Jan. 1977 79 p refs
(Contract N00019-76-C-0495)
(AD-A038350; HAL-Ref-D6170; Rept-2753/981) Avail: NTIS HC A05/MF A01 CSCL 17/9

Flush mounted slot antenna systems on metallic cones or ogival surfaces can be inertialessly scanned in the required direction. Since scanning over a wide angular region is generally desired, the radiation characteristics, including the effect of mutual coupling on the radiating elements, must be investigated before the more detailed system aspects are considered. To this end, various approximation techniques have been examined for use in pattern calculations and in impedance calculations. These include the approximate asymptotic approach and the equivalence principle technique. The approximation techniques provide simplified computations as compared with the exact technique, and are not applicable to all conditions. A combination of exact and approximation techniques is generally required to design or analyze an array. The approximate asymptotic approach, which allows the separation of the diffracted field and geometrical optics fields, has been examined in detail. It appears that the asymptotic representation of the Legendre function chosen for the analysis leads to divergent expressions as the mode number m is increased, and hence limits the usefulness of the asymptotic approach in the present problem. The divergent nature of the asymptotic expression is verified by computed radiation patterns of several azimuthal modes. A computer program is being developed to apply the equivalence principle technique to a conical surface.
GRA

N77-28365# Rome Air Development Center, Griffiss AFB, N.Y.
SIMULATION OF LEADING EDGES OF BACKSCATTER IONOGRAMS FOR IONOSPHERIC INFERENCES
Ming S. Wong Nov. 1976 24 p refs
(AF Proj. 5631)
(AD-A038532; RADC-TR-76-354) Avail: NTIS HC A02/MF A01 CSCL 17/9

Jones' ray-tracing program and integrated subroutines by Langworthy and Barrett are being used to compute swept-frequency ionograms, for backscatter by ground and field-aligned ionization, in the presence of sharp horizontal boundaries in electron-density distributions. Prominent characteristics, minimum group-path traces, ray-density variations, and off-great-circle deviation along ray paths are presented for various alterations on major features of initial electron distributions. Author (GRA)

N77-28366# Rome Air Development Center, Griffiss AFB, N.Y.
EFFECT OF MULTIPATH ON THE HEIGHT-FINDING CAPABILITY OF FIXED-REFLECTOR RADAR SYSTEMS. PART 4: EFFECT OF SYSTEM NOISE
Ronald L. Fante, Peter R. Franchi, and Richard L. Taylor Jan. 1977 30 p refs
(AF Proj. 4600)
(AD-A038833; RADC-TR-77-47) Avail: NTIS HC A03/MF A01 CSCL 17/9

The effect of noise and clutter on the elevation accuracy of the reflector radar system described in RADC/TR-76-215 were studied. It was found that the elevation error can be separated into two contributions: one due to multipath alone and the other, which is a combination of the effects of noise, multipath, and ground clutter. GRA

N77-28367# Naval Electronics Lab. Center, San Diego, Calif.
RADOME DEVELOPMENT FOR A BROADBAND RF MISSILE

SENSOR (MULTILAYERED POWER SERIES RADOME WITH INTEGRATED LENS PROVIDES EXCELLENT DRAG CHARACTERISTICS AND ELECTRICAL BORESIGHT ERROR PERFORMANCE) Research and Development Report, Aug. - Dec. 1976

F. D. Groutage 25 Jan. 1977 105 p refs
(AD-A038262; NELC-TR-2023) Avail: NTIS HC A06/MF A01 CSCL 17/7

An integrated radome/lens concept is developed for a multioctave RF radiation sensor guided missile application. Aerodynamic properties, drag, and thermal heating are analyzed. Electrical properties, transmissivity, and boresight error are optimized by using a layered wall construction and integrating a lens into the inner surface of the radome. Missile performance is evaluated with the integrated radome/lens used as part of the missile system. Author (GRA)

N77-28368# Arcon Corp., Wakefield, Mass.
IONOSPHERIC ANALYSIS AND IONOSPHERIC MODELING Final Report, Jul. 1973 - Oct. 1976

David C. Miller and Joseph Gibbs Feb. 1977 100 p refs
(Contract F19628-74-C-0070)
(AD-A038298; RADC-TR-77-53) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report describes several investigations performed towards improving our ability to communicate through the ionospheric medium. These studies covered two distinct and separate areas. The first was concerned with improvements in ionospheric forecasting in the polar region through the development of empirical models for electron density profiles and ionospheric parameters. The second consisted of the study of various techniques for the establishment of high frequency communication circuit parameters. Attempts have been made to accurately determine ray paths for ionospheres with simple gradients without the use of three dimensional ray tracing techniques. Author (GRA)

N77-28369# Army Communications-Electronics Engineering Installation Agency, Fort Huachuca, Ariz.
PERFORMANCE ANALYSIS SUMMARY OF HF RADIO OPERATIONS FOR THE 5TH SPECIAL FORCES GROUP (AIRBORNE), SIGNAL GROUP EXERCISE JACK FROST 77 Final Report

William Alvarez and George Lane 23 Dec. 1976 52 p
(AD-A038278; CCC-EMEO-PED-76-31) Avail: NTIS HC A04/MF A01 CSCL 17/2

An analysis of radiowave propagation conditions expected to prevail during Exercise Jack Frost 77 is given. Antenna designs and frequencies that will take full advantage of the ionospheric mode of propagation are presented. Author (GRA)

N77-28370# Army Communications-Electronics Engineering Installation Agency, Fort Huachuca, Ariz.
GROUND-TO-AIR COMMUNICATIONS USING LINE-OF-SIGHT IN THE HIGH FREQUENCY BAND

George Lane and Charles Masen Mar. 1977 46 p refs
(AD-A038608; CCC-EMEO-PED-77-5) Avail: NTIS HC A03/MF A01 CSCL 17/2

A relatively straight forward approach is presented for estimating ground-to-air communications capability using line-of-sight in the HF band. The approach allows for the incorportation of a numerically determined antenna radiation pattern. Two programs for use on desk-top type of computers are provided: one for determining the line-of-sight range to an aircraft and the other for predicting the received signal power level at the aircraft. Example solutions are given. Author (GRA)

N77-28371# Army Electronics Command, Fort Monmouth, N. J.
AIDATS - CEFLY LANCER DATA LINK COMMONALITY STUDY

James E. Bartow May 1976 28 p refs
(AD-A038852; ECOM-4416) Avail: NTIS HC A03/MF A01 CSCL 17/2

The purpose of this study and engineering evaluation effort was to determine a means of introducing a degree of commonality into the design of the wide band data links for the AIDATS and the CEFLY LANCER programs. The method of attack was to determine the feasibility of modifying the procurement of AIDATS hardware to introduce equipments developed for the CEFLY LANCER program. This approach was followed since the CEFLY LANCE engineering development had been completed while the AIDATS engineering development phase was just starting. The overall objective of this effort was to follow the course of action which would result in the most cost effective data link equipment for both programs. The Army Inflight Data Transmission Systems (AIDATS) AN/USQ-49 (V) is an outgrowth of the JIFDATS program which was begun in 1969. After the joint service effort was discontinued in June 1973, it still appeared to hold the best promise of providing a wide band data link for the AN/APS-94 radar in the Army OV-ID Mohawk aircraft. The Army, therefore continued its portion of the program, hoping to achieve a successful feasibility demonstration of a near-real-time, all weather, day-or-night digital data transmission system as early as possible. GRA

N77-28372# GTE Sylvania, Inc., Needham Heights, Mass. Electronic Systems Group.
MEGABIT DIGITAL TROPOSCATTER SUBSYSTEM (MDTS) Final Report, Dec. 1974 - Jul. 1976

Dale R. Kern and Peter Monsen Ft. Monmouth, N. J. ECOM Feb. 1977 194 p refs Prepared in cooperation with Signatron, Inc.
(Contract DAAB07-74-C-0040; DA Proj. 1X7-64701-D-149)
(AD-A038117; ECOM-74-0040-F) Avail: NTIS HC A09/MF A01 CSCL 17/2

This document covers the results of work performed on the Megabit Digital Troposcatter Subsystem Program under Contract DAAB07-74-C-0040. The primary objective of the MDTS is to provide a wideband digital data modem and approximate link modifications to convert established DCS links from analog to digital operation. Results of laboratory and field tests are contained with performance of digital troposcatter communication rates of 1.544, 3.088, 6.276 and 12.6 Mb/s being presented. Author (GRA)

N77-28373# Illinois Univ., Urbana-Champaign. Dept. of Electrical Engineering.
TECHNIQUES OF DETERMINING IONOSPHERIC STRUCTURE FROM OBLIQUE RADIO PROPAGATION MEASUREMENTS Final Report, Oct. 1974 - Sep. 1976

N. Narayana Rao, K. C. Yeh, M. Y. Youakim, K. E. Hoover, and P. Parhami Dec. 1976 280 p refs
(Contract F19628-75-C-0088; AF Proj. 5631)
(AD-A038299; UILU-Eng-76-2559; TR-59; RADC-TR-76-401)
Avail: NTIS HC A13/MF A01 CSCL 17/2

Computer techniques are developed to home the ray at a specified location with specified accuracy. Several methods have been investigated whereby oblique radio propagation data can be used to obtain ionospheric profiles. In one method the optimum quasiparabolic layer can be found that is supposed to fit the given data within a tolerable error. Another method makes use of the Backus-Gilbert inversion technique. Author (GRA)

N77-28374# Naval Electronics Lab. Center, San Diego, Calif.
OVER-THE-HORIZON OPTICAL SCATTER COMMUNICATION IN THE MARINE BOUNDARY LAYER. OTH PROPAGATION MEASUREMENTS INCLUDING PATH LOSS AND PULSE DISTORTION IN THE BLUE-GREEN AND AT 1.06 MICROMETERS ARE PRESENTED FOR USE IN SYSTEM DESIGN Research and Development Report, Jan. - Dec. 1976

G. C. Mooradian, M. Geller, R. Krautwald, and D. H. Stephens 28 Jan. 1977 20 p refs
(NELC Proj. B195; XF21222025)
(AD-A038708; NELC-TR-2022) Avail: NTIS HC A02/MF A01 CSCL 17/2

Measurements of optical propagation over-the-horizon caused by scattering from normal marine atmospheric aerosols have been made at range of 40 miles. Path loss, scattered beam angular distributions, and pulse distortion have been measured both at 1.06 micrometers and in the blue-green. Except for anomalies in expected forward scatter function, the results are in reasonable agreement with the propagation model. Based upon results of the propagation model and experimental results, communications system performance is determined using existing components.

Design and construction of a one-way communication link between NELC and San Clemente Island (128 km) are in progress. GRA

N77-28375# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
CHANGE DETECTION AND ANALYSIS IN MULTI-SPECTRAL IMAGES Interim Report
Keith Edward Price 18 Dec. 1977 216 p refs
(Contract F44620-73-C-0074)
(AD-A038843; AFOSR-77-0448TR) Avail: NTIS HC A01/MF A01 CSCL 15/4

This thesis describes research toward the development of a general image understanding system. The system has been directed toward the problem of the comparison of pairs of different images of the same scene to generate descriptions of the changes in the scene. Unlike earlier work in the change analysis area, all the matching and change analyses were performed at a symbolic level rather than a signal level. To facilitate this symbolic analysis over a wide variety of images, advances in several other areas of image analysis were also required. Several diverse scenes (house, cityspace, satellite images, aerial images, and radar images) are presented, each of which has a task description and a predefined set of knowledge elements, and will show how several different tasks can be performed with a general change analysis system. Early segmentation techniques were either designed for specific applications or were very expensive. The segmentation of an image into regions by a histogram based region splitting procedure has proved to be useful over a wide range of images, but also tends to be expensive (Ohlander, 1975). In order to make this procedure more efficient, the use of 'planning' was incorporated into the segmentation processing. This use of planning means that the segmentation is generated in about a tenth (or better) of the time required without planning. GRA

N77-28376# National Bureau of Standards, Washington, D. C. Inst. for Basic Standards.
RELATIVISTIC MANY-BODY BOUND SYSTEMS: ELECTRO-MAGNETIC PROPERTIES
Michael Danos and Vincent Gillet (Centre d'Etudes Nucleaires de Saclay) Apr. 1977 56 p refs
(PB-265096/8; NBS-Mono-147-Suppl-1) Avail: NTIS HC A04/MF A01 CSCL 20H

The formulae for the calculation of the electron scattering form factors, and of the static magnetic dipole and electric quadrupole moments, of relativistic many-body bound systems are derived. The framework is relativistic quantum field theory in the Schrodinger picture; the physical particles, i.e., the solutions of the interacting fields, are given as linear combinations of the solutions of the free fields, called the parton fields. The parton-photon interaction is taken as given by minimal coupling. In addition, the contribution of the photon-vector meson vertex of the vector dominance model is derived. GRA

N77-28377# Illinois Univ., Urbana-Champaign. Dept. of Computer Science.
TRANSMISSION OF ANALOG SIGNALS USING BURST TECHNIQUES M.S. Thesis
Martin Wolff 1977 48 p refs
(Contract N00014-75-C-0982)
(AD-A036465; UIUCDCS-R-77-838; UILU-eng-77-1701) Avail: NTIS HC A03/MF A01 CSCL 17/2

Burst techniques are considered as possible alternatives to conventional ones in the realm of digital transmission of analog signals. Three demonstration systems using various Burst techniques are discussed in detail. Author (GRA)

N77-28378# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
ENVIRONMENT AND RADAR OPERATION SIMULATOR Quarterly Report, 1 Jul. - 30 Sep. 1976
S. N. Cole, A. R. Clayton, E. R. Flynt, R. C. Michelson, B. S. Rice, and E. S. Sjoberg Dec. 1976 22 p
(Contract DAAB07-74-C-0272; DA Proj. 1S7-62703-DH-93)
(AD-A036656; ECOM-74-0272-9; QR-9) Avail: NTIS HC A02/MF A01 CSCL 17/9

This report summarizes activities during the ninth quarter of a program sponsored by the U. S. Army Electronics Command (ECOM), directed toward the design of an Environment and Radar Operation Simulator (EROS). Work has continued on the three major subsystems of EROS; the digital hardware, the software, and the analog hardware. Included in this report are discriptions of the completed units, the progress in documentation, and a statement about the remaining units to be completed. Author (GRA)

N77-28379# California Univ., Santa Barbara. Geography Remote Sensing Unit.
SUMMARY EVALUATION OF THE OFFSHORE TARGET DETECTION CAPABILITIES OF APS-94D AND COR RADAR SYSTEMS Final Report, May - Jul. 1976
John E. Estes and Steven P. Kraus Dec. 1976 120 p
(Contract DOT-CG-63898-A)
(AD-A036245; USCG-D-125-76) Avail: NTIS HC A06/MF A01 CSCL 17/9

Flight test of an APS-94D real aperture and coherent-on-receive (COR) synthetic aperture radar were conducted by the Coast Guard in three locations of southern and central coastal California between May 19-21 1976. The Geography Remote Sensing Unit provided comprehensive ground truth support coincident with radar overflights. Imagery from the APS-94D and COR radar sets was interpreted and evaluations of the target detection capabilities and resolution characteristics of the two systems conducted. The analysis included both man-made targets and natural seep oil slicks. Author (GRA)

N77-28380# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTIMUM SPEECH CLASSIFICATION AND ITS APPLICATION TO ADAPTIVE NOISE CANCELLATION
Robert J. McAulay 9 Nov. 1976 61 p refs
(Contract F19628-76-C-0002)
(AD-A036324; TN-1976-39; ESD-TR-76-320) Avail: NTIS HC A04/MF A01 CSCL 09/4

The problem of determining whether a given interval of a speech signal should be classified as voiced speech, unvoiced speech or silence is formulated as a test of statistical hypotheses. A robust detector is obtained by modelling the speech and the acoustic background noise signals as correlated Gaussian random processes. The methods of statistical decision theory are applied to these models to synthesize an optimum, minimum probability of error, classifier. The optimum classifier is an estimator-correlator receiver which is well approximated using a linear phase high pass filter in the unvoiced channel and a linear phase low pass filter in the voiced channel. A clutter filter appears in the reference channel which tries to eliminate as much noise as possible before forming the unvoiced and voiced correlations. The statistics of the noise are learned during the silent intervals which makes the classifier adaptive to time-varying noise statistics. GRA

N77-28381# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Industrial Engineering and Operations Research.
VISUAL SEARCH IMAGE QUALITY Final Technical Report, 15 Jun. 1971 - 14 Oct. 1975
Harry L. Snyder Wright-Patterson AFB, Ohio AMRL Dec. 1976 77 p refs
(Contract F33615-71-C-1739)
(AD-A036263; AMRL-TR-76-89) Avail: NTIS HC A05/MF A01 CSCL 17/8

This report presents the results of an air-to-ground television target acquisition experiment which investigated the effects of mission profile, video system line rate and bandwidth, and video noise level. The target acquisition performance data are related to these variables and to a measure of display image quality, the Modulation Transfer Function Area (MTFA), which is measured microphotometrically at the display surface. The target acquisition performance results are largely as expected. For a camera field of view of 18.8 x 14.2 deg, the mean ground ranges of correctly acquired targets are 28,661, 24,376, and 12,171 ft, respectively, for mission profiles of 23 deg depression angle, 500 ft/s velocity; 23 deg, 3000 ft/s; and 45 deg, 500 ft/s. As depression angle decreased, there was a large decrease in acquisition range; as velocity increased, there was a smaller decrease in acquisition range. Altitude was 10,000 ft. GRA

N77-28382# Stanford Research Inst., Menlo Park, Calif.
IONSPHERIC EFFECTS ON RADIO PROPAGATION. A SUMMARY AND SELECTED ANALYSIS OF IONOSPHERIC MEASUREMENTS IN THE ROCKET AND SATELLITE TRACKING PROGRAMS OF THE US ARMY BALLISTIC RESEARCH LABORATORIES
Warren W. Berning Sep. 1976 59 p refs
(Contract DNA001-74-C-0167)
(AD-A036310; DNA-4119T) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report is intended to be a very brief survey of work carried out by the U.S. Army Ballistic Research Laboratories in that portion of their upper atmosphere research program concerned with ionospheric effects on radio propagation. The thrust of this present effort has been the extraction and discussion of ionospheric effects on radio propagation which continue to be of importance in the performance and effectiveness of communications systems. GRA

N77-28383# Rome Air Development Center, Griffiss AFB, N.Y.
MULTIPLE MODE CONTROL OF GRATING LOBES IN LIMITED SCAN ARRAYS
Robert Mailloux, Lore Zahn, Anthony Martinez, III, and George Forbes Sep. 1976 48 p refs
(AF Proj. 4600)
(AD-A036323; RADC-TR-76-307) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report is the fourth in a series describing the use of multiple higher order modes for grating lobes control in arrays of large aperture elements scanned over restricted spatial sectors. Arrays of this type are useful in a number of applications including precision approach radar, weapons locators and satellite communications systems. The report summarizes an extensive experimental and theoretical study that includes the design and use of dielectric lenses for control of E-plane null filling for an 8-element array, the investigated. A computer model has been developed to study the effect on the boresight of a noise source in the near field of a monopulse antenna. Author (GRA)

N77-28384# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Advanced Sensors Directorate.
MEASUREMENT OF TRANSMITTER NOISE AT HIGH FREQUENCY THROUGH MICROWAVE FREQUENCIES
T. A. Barley, G. J. Rast, Jr., and J. R. Ashley 22 Sep. 1976 107 p refs
(AD-A036389; RE-7T-8) Avail: NTIS HC A06/MF A01 CSCL 09/3

A tutorial review of the basis for transmitter noise measurements shows that noise is best described and measured as AM and FM noise. The contribution of AM noise to RF spectrum shape is determined by the power spectral density shape of the AM noise. The contribution of FM noise to the RF spectrum is to make the shape that of an RLC resonant circuit response rather than a delta function with a sideband structure. AM noise is measured with a direct detector diode. FM noise for frequencies above 5 GHz is measured with a discriminator based on a one-port cavity. FM noise below 15 GHz is measured with an improved transmission line discriminator which is described in detail. The most widely used baseband analyzer is the constant bandwidth superheterodyne wave or spectrum analyzer. The baseband spectrum analyzer has been automated. Complete calculator programs with brief descriptions are presented in the Appendix. Author (GRA)

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N77-28385* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUSTAINED ARC IGNITION SYSTEM Patent
Arthur G. Birchenough, inventor (to NASA) Issued 5 Jul. 1977 10 p Filed 3 Jun. 1975 Supersedes N75-25056 (13 - 16, p 1956)
(NASA-Case-LEW-12444-1; US-Patent-4,033,316; US-Patent-Appl-SN-583485; US-Patent-Class-123-148E; US-Patent-Class-123-148CB; US-Patent-Class-315-176) Avail: US Patent Office CSCL 09C

Circuitry for maintaining an arc or spark across a spark gap for a desired length of time is disclosed. A high voltage, direct current source is connected in series with a secondary winding of a high voltage, stepup transformer or coil and a spark gap such as a spark plug for example. The high voltage source may be on continuously or may be turned on and off by a control circuit such as a solid state switch which is, in turn, responsive to a timing device such as a set of ignition contact points or a magnetic pulse generator operating in synchronism with a spark ignition engine. The timing device also provides signals to a current switching circuit which interrupts, current flow through a primary winding of the high voltage coil at the prescribed time that a spark is desired at the spark gap.
Official Gazette of the U.S. Patent Office

N77-28386 Texas Univ., Austin.
A STUDY OF ELECTROFORMING PROCESSES AT METAL-TIN SELENIDE INTERFACES Ph.D. Thesis
Dong-woo Chun 1976 116 p
Avail: Univ. Microfilms Order No. 77-3878

The physical changes produced by electroforming and leading to bistable memory switching were investigated for metal, Sn-Se semiconductor structures. Evaporated aluminum contacts on crystalline Sn-Se were initially ohmic but became rectifying with annealing. Identical isothermal structures exhibited a Schottky barrier with polarity-dependent memory switching when subjected to an electroforming process. The electroformed samples gave superior rectifying properties to those isothermally processed. The degradation of the ohmic contact in the equilibrium process was shown to result from the recrystallization of Sn in Al to the solid solubility limits. The nonequilibrium process forces a slight deviation from stoichiometry in a very short time period with little power producing cyclic polarity-dependent memory switching. Dissert. Abstr.

N77-28387 California Univ., Los Angeles.
DESIGN TECHNIQUES FOR CIRCULAR APERTURE ANTENNAS Ph.D. Thesis
Odell Graham 1976 147 p
Avail: Univ. Microfilms Order No. 77-1632

The far field radiation patterns, of two distinctly different circular aperture antennas are analyzed. The first of these is a special type of quasi-ring array--the towel bar array of N elements, where N is an even number. It is shown that the complete set of model radiation patterns can be characterized in the form of a set of very simple algebraic expressions. Further, it is shown that there is an N/2th order degeneracy. An example is given for the case of a six element towel bar array. In addition, techniques are introduced for the synthesis of planar circular apertures to achieve highly directive radiation patterns which admit the arbitrary control of the heights of specific sidelobes. An illustrative example shows that, using these techniques, the desired sidelobe topology can be achieved in a practical design. Dissert. Abstr.

N77-28388 Washington State Univ., Pullman.
TURBULENT MOTION OF CHARGED MICRON-SIZED PARTICLES IN AN ELECTRIC FORCE FIELD Ph.D. Thesis
John Thomas Jurewicz 1976 169 p
Avail: Univ. Microfilms Order No. 77-2868

The role of turbulence in modifying the migration of solid particles in an electrostatic precipitator is studied. Emphasis was placed on the turbulent diffusion of particles in a steep concentration gradient. A laser Doppler velocimeter operating in a forward scattering fringe mode was used to measure the particle velocity profiles in the longitudinal and transverse direction at several locations. Three sizes of alumina particles were employed and seeding was achieved by a fluidized bed particle feeder. The

gas-particle flow field was predicted numerically using a pressure-velocity formulation for the gas flow field and a Lagrangian approach for the particle motion. The parametric study confirms that turbulent diffusion acts to oppose the collection of particles and demonstrates that fluid properties have a significant influence on particle motion. Dissert Abstr.

N77-28389# Office of Naval Research, Arlington, Va.
AN INVESTIGATION OF THE LIGHTING ELIMINATION AND STRIKE REDUCTION PROPERTIES OF DISSIPATION ARRAYS Final Report
Rodney B. Bent and Sigrid K. Llewellyn May 1976 99 p refs
(Contract DOT-FA75WAI-507)
(AD-A039588; FAA-RD-77-19) Avail: NTIS HC A05/MF A01 CSCL 09/1

The dissipation of thunderclouds to the point where lightning is inhibited is discussed along with the physical process related to cloud dissipation and a theoretical investigation of electrostatic field and corona around tower structures. The investigation and measurements of single point and multiple point corona currents are outlined. The results of photographic recordings and magnetic link current measurements of lightning are presented. Previous data provided from facilities using the multiple point concept to eliminate lightning are correlated with a current analysis. Based on theoretical work, experimental tests and photographic data, the conclusions are that multiple points in a practical situation do not produce more corona current than a single point and that multiple points do not eliminate lightning and do not provide any more protection than a conventional lightning protection system. Author

N77-28390# Rome Air Development Center, Griffiss AFB, N.Y.
VACUUM TUBE AVAILABILITY ASSESSMENT PROGRAM Final Report, 1 Jan. 1976 - 31 Jan. 1977
R. M. Cosel, G. K. Huddleston, and W. D. Peele Feb. 1977 66 p refs
(Contract DOT-FA72WAI-356)
(AD-A039273; FAA-RD-77-27) Avail: NTIS HC A04/MF A01 CSCL 09/1

The continued availability of vacuum tubes and solid state replacement devices to support representative FAA equipments through the 1980's is considered. The reduced availability of vacuum tubes is due mainly to the massive transition to solid state equipment by the consumer entertainment industry. This action has led to a large reduction of vacuum tube suppliers, and to a significant increase in the cost of vacuum tubes. Price and tube demand data are presented for the selected VOR systems. The applicability of solid state replacement devices to the FAA equipment is discussed. Author

N77-28391*# Nelson and Johnson Engineering, Inc., Boulder, Colo.
ELECTROSTATIC FORCES FOR PERSONNEL RESTRAINTS Final Report
Neil Ashby, John Ciciora, Robert Gardner, and Kenneth Porter 20 Jul. 1977 156 p refs
(Contract NAS9-15228)
(NASA-CR-151473; MA-183TF) Avail: NTIS HC A08/MF A01 CSCL 09C

The feasibility of utilizing electrostatic forces for personnel retention devices on exterior spacecraft surfaces was analyzed. The investigation covered: (1) determination of the state of the art; (2) analysis of potential adhesion surfaces; (3) safety considerations for personnel; (4) electromagnetic force field determination and its effect on spacecraft instrumentation; and (5) proposed advances to current technology based on documentation review, analyses, and experimental test data. Author

N77-28392*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT TRANSFORMER AND INDUCTOR DESIGN
W. T. McLyman 15 Aug. 1977 290 p refs
(Contract NAS7-100)
(NASA-CR-154104; JPL-Publ-77-35) Avail: NTIS HC A13/MF A01 CSCL 09C

The conversion process in spacecraft power electronics requires the use of magnetic components which frequently are the heaviest and bulkiest items in the conversion circuit. This handbook pertains to magnetic material selection, transformer and inductor design tradeoffs, transformer design, iron core dc inductor design, toroidal power core inductor design, window utilization factors, regulation, and temperature rise. Relationships are given which simplify and standardize the design of transformers and the analysis of the circuits in which they are used. The interactions of the various design parameters are also presented in simplified form so that tradeoffs and optimizations may easily be made. Author

N77-28393*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN AND PROTOTYPE FABRICATION OF A 30 TESLA CRYOGENIC MAGNET
G. M. Prok, M. C. Swanson, and G. V. Brown Aug. 1977 16 p refs Presented at the 1977 Cryog. Eng. Conf., Boulder, Colo., 2-5 Aug. 1977
(NASA-TM-X-73660; E-9177) Avail: NTIS HC A02/MF A01 CSCL 20C

A liquid neon cooled magnet was designed to produce 30 teslas in steady operation. To ensure the correctness of the heat transfer relationships used, supercritical neon heat transfer tests were made. Other tests made before the final design included tests on the effect of the magnetic field on pump motors, tensile shear tests on the cryogenic adhesives, and simulated flow studies for the coolant. The magnet will consist of two pairs of coils, cooled by forced convection of supercritical neon. Heat from the supercritical neon will be rejected through heat exchangers which are made of roll bonded copper panels and are submerged in a pool of saturated liquid neon. A partial mock up coil was wound to identify the tooling required to wind the magnet. This was followed by winding a prototype pair of coils. The prototype winding established procedures for fabricating the final magnet and revealed slight changes needed in the final design. Author

N77-28394*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
CABLE FAULT LOCATOR Patent Application
Robert L. Cason and John J. McStay, inventors (to NASA) Filed 8 Jul. 1977 12 p
(NASA-Case-KSC-10899-1; US-Patent-Appl-SN-814004) Avail: NTIS HC A02/MF A01 CSCL 09C

A cable fault locator for sensing faults such as short circuits in power cables is reported. The apparatus includes a plurality of current transformers strategically located along said cable. Trigger circuits are connected to each of the current transformers for placing a resistor in series with a resistive element responsive to an abnormally high current flowing through that portion of the cable. By measuring the voltage drop across the resistive element, the location of the fault can be determined. NASA

N77-28395*# National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD AND APPARATUS FOR PROVIDING A SERVO DRIVE SIGNAL IN A HIGH-SPEED STEPPING INTERFEROMETER Patent Application
Rudolf A. Schindler, inventor (to NASA) (JPL) Filed 6 Jun. 1977 30 p
(Contract NAS7-100)
(NASA-Case-NPO-13569-2; US-Patent-Appl-SN-804035) Avail: NTIS HC A03/MF A01 CSCL 09C

In infrared spectroscopy utilizing an interferometer, position stepping of the optical path difference in the interferometer is accomplished by causing a drive signal to be applied to the movable mirror in the interferometer. This signal is proportional to the offset distance desired from the previous null point. As the mirror moves in response to this drive signal, effectively getting closer to the new null point, the drive signal is gradually reduced, in response to detected reference laser fringes. A binary up/down counter drives a digital/analog converter (DAC). The output from the DAC is supplied to the mirror moving means. The fringes generated by a reference laser are detected as the mirror moves, causing the up/down counter to be decremented to its null count, thereby reducing the output of the DAC, as the mirror moves towards its new null position. NASA

N77-28396# Los Alamos Scientific Lab., N. Mex.
INDUCTANCE CALCULATIONS FOR RECTANGULAR CONDUCTORS
J. M. Christian Jan. 1977 7 p refs
(Contract W-7405-eng-36)
(LA-6657-MS) Avail: NTIS HC A02/MF A01

The theoretical basis and development of the inductance formula for straight, parallel conductors of rectangular cross section are reviewed. Sample calculations for the self and mutual inductances of dual- and triple-conductor configurations are given, demonstrating the application of the geometric mean distance theorem of Maxwell. ERA

N77-28397# California Univ., Livermore. Lawrence Livermore Lab.
A LAYOUT SYSTEM FOR PRINTED CIRCUIT BOARDS
Robert J. Smith, II 13 Aug. 1976 11 p refs Presented at the AESOP XV Conf., Denver, Colo., 30 Sep. 1976
(Contract W-7405-eng-48)
(UCRL-78563; Conf-761120-1) Avail: NTIS HC A02/MF A01

A computer-aided printed circuit board layout system was developed which is now being used to produce a variety of PC board designs. The system is able to handle boards with arbitrary trimline geometries having up to about 100 IC's. It was designed to achieve 90 to 95 percent automatic connection rates on two layer boards, and has also been used to produce four layer boards. Practical considerations which must be treated in development of an automated PC board layout system and the structure of the system are discussed. Performance of the system and a critique of the system design are presented. ERA

N77-28398# Argonne National Lab., Ill. Solid State Science Div.
SUPERCONDUCTING FAULT CURRENT LIMITER Final Report
K. E. Gray and D. E. Fowler Dec. 1976 43 p Sponsored by EPRI
(EPRI-EL-329) Avail: NTIS HC A03/MF A01

The use of a superconducting element as the active part of a fault current limiter for the power utilities is considered. Such a device is technically feasible over a wide range of parameters for the required electrical power source and material properties of the superconductors available. Limiting is achieved by driving the superconductor into its resistive state and commuting the current into a shunt resistor. For a three phase, 145 kV (RMS), 2 KA (RMS) line, the total cost excluding installation in the power system and shunt resistor is approximately $300,000. The specific advantages and disadvantages are indicated, as well as the outstanding problems to be tackled next. ERA

N77-28399# California Univ., Berkeley. Lawrence Berkeley Lab.
AMORPHOUS GERMANIUM AS AN ELECTRON OR HOLE BLOCKING CONTACT ON HIGH PURITY GERMANIUM DETECTORS
William L. Hansen and E. E. Haller Oct. 1976 12 p refs Presented at the Nucl. Sci., Scintillation and Semiconductor Counter Symp., New Orleans, 20 Oct. 1976
(Contract W-7405-eng-48)
(LBL-5564; Conf-761006-33) Avail: NTIS HC A02/MF A01

Experiments were performed in an attempt to make thin n(+) contacts on high-purity germanium by the solid phase/sup 1/ epitaxial regrowth of arsenic doped amorphous germanium. After cleaning the crystal surface with argon sputtering and trying many combinations of layers, it was not found possible to induce recrystallization below 400 C. However, it was found that simple thermally evaporated amorphous Ge made fairly good electron or hole blocking contacts. Excellent spectrometers were made with amorphous Ge replacing the n(+) contact. As presently produced, the amorphous Ge contact diodes show a large variation in high voltage leakage current. ERA

N77-28400# Stanford Univ., Calif.
STUDY OF CRITICAL CURRENTS OF VERY THIN MULTI-LAYERED STRUCTURES Final Report
T. H. Geballe and M. R. Beasley Jun. 1976 161 p refs Sponsored in part of Elec. Power Res. Inst.
(Contract E(49-18)-1569; EPRI Proj. 78-22)
(EPRI-TD-193) Avail: NTIS HC A08/MF A01

Research aimed at developing a high current density superconducting power transmission line with low ac losses is reported. Specifically, a study is made of the enhancement of the maximum superconducting current density that can be sustained in Nb3Sn through formation of fine scale layered composites. Procedures are described which enable fabrication of these composites by electron beam evaporation. In addition, studies on dielectric losses in potential low temperature insulating materials are surveyed. Relevant supplementary information is presented. ERA

N77-28401# General Electric Co., Schenectady, N.Y.
DESIGN, FABRICATION, AND EVALUATION OF AN ELECTRON BEAM ADDRESSABLE HIGH INFORMATION DENSITY MEMORY TUBE Final Report, 1 Mar. 1975 - 31 Aug. 1976
Charles Q. Lemmond, Conilee G. Kirkpatrick, George E. Possin, William C. Hughes, T. H. Klotz, Jr., and J. K. Fisher Feb. 1977 99 p refs
(Contract DAAB07-75-C-1312; DA Proj. 1S7-62705-AH-94)
(AD-A037642; SRD-77-035; ECOM-75-1312-F) Avail: NTIS HC A05/MF A01 CSCL 09/2

BEAMOS tubes, designed and constructed prior to this contract, were tested to determine their ability to meet various environmental requirements. Although the tubes were not designed specifically with these requirements in mind, data were gained during the tests for use in effecting a re-design of the tube. Two tubes were fabricated embodying the suggested design improvements. Other design improvements, brought about by General Electric's inhouse BEAMOS development program, were also included. The two tubes so constructed were tested and shown to meet the operational performance goals. The tubes were delivered to the Army. More specifically, several improvements were made to the electron optics of the BEAMOS tube. These changes were made to produce stable operation of the tube under various environmental requirements. GRA

N77-28402# Radio Corp. of America, Lancaster, Pa. SSD-Electro-Optics and Devices.
MANUFACTURING METHODS AND TECHNOLOGY (MM AND T) MEASURE FOR FABRICATION OF SILICON TRANSCALENT THYRISTOR Quarterly Report, 27 Sep. - 31 Dec. 1976
S. W. Kessler, A. W. Mannon, and R. E. Reed Jan. 1977 170 p refs
(Contract DAAB07-76-C-8120)
(AD-A038429; QR-1) Avail: NTIS HC A08/MF A01 CSCL 09/1

This First Quarterly Report describes the MM and TE program for Transcalent (heat-Pipe cooled) thyristors. A description of the device and the pertinent state-of-the-art at the inception of the program is included. Progress on redesigning for production is described for the device parts, processes and sub-assemblies. Also described are the problems encountered in the design of the high current, high voltage test equipment. Block diagrams of the circuit designs are included. The present status includes the completion of the fixtures and the process specifications, the procurement of device parts, and the initiation of sub-assembly work as well as the procurement of the electronic components for the modification of fabrication of the electrical test equipment. Plans for the next quarter include completion of the engineering sample devices. Author (GRA)

N77-28403# Pennsylvania State Univ., University Park. Materials Research Lab.
CERAMIC PIEZOELECTRIC TRANSDUCERS Annual Summary Report, 1 Jan. - 31 Dec. 1976
L. E. Cross, J. V. Biggers, and R. E. Newnham 31 Jan. 1977 66 p refs
(Contract N00014-76-C-0515)
(AD-A038152) Avail: NTIS HC A04/MF A01 CSCL 09/1

This report documents progress in the first year of a comprehensive program to develop new and improved materials for ceramic piezoelectric transducers. GRA

N77-28404# Harry Diamond Labs., Adelphi, Md.
A TENTATIVE MODEL OF THE Si-SiO2 INTERFACE
Martin M. Sokoloski Feb. 1977 47 p refs
(DA Proj. 1T1-61102-AH-44; HDL Proj. A44628)
(AD-A038540; HOL-TR-1787) Avail: NTIS HC A03/MF A01 CSCL 09/1

A model of the electronic density of states in a metal-insulator-semiconductor structure is proposed. The model is based upon current theories of the electronic properties of amorphous materials and disordered alloys. The model accounts for the presence of 'band-tail' states at the insulator-semiconductor interface and also speculates about the presence of states in the oxide as being due to persistent silicon conduction and valence bands. The derivation of the admittance of a metal-oxide-semiconductor capacitor with a distribution of the interface states is reviewed, and an interpretation of these states employing the macroscopic theory of Brews is later derived. It is shown how these states can be measured by a quasi-static capacitance voltage measurement. Author (GRA)

N77-28405# Army Electronics Command, Fort Monmouth, N. J.
ADIABATIC MODE OPERATION OF THYRATRONS FOR MEGAWATT AVERAGE POWER APPLICATIONS
John E. Creedon, Anthony J. Buffa, and Joseph McGowan Feb. 1977 20 p
(AD-A038687; ECOM-4470) Avail: NTIS HC A02/MF A01 CSCL 09/1

Significant impact on the size, weight, and cost of high energy pulse systems having short on times can be obtained by designing components to operate in the adiabatic mode. Several thyratron design concepts for short term, high peak and average power switching applications have been studied. They include cavity grid designs for high voltage reliability, grid baffling designs to improve anode take over times, and plasma cathode designs to eliminate standby filament power. Using these concepts, several thyratron designs have been fabricated and evaluated at average powers approaching one megawatt. Evaluation of an off the shelf HY-5 operating in the adiabatic mode, was also conducted. It was found that by modifying the cathode structure the device was capable of being operated reliably at 22.5 amperes of average current at a peak voltage of 15 kilovolts. GRA

N77-28406# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM FOR BEAM LEAD SEALED JUNCTION SEMICONDUCTOR DEVICES Quarterly Progress Report, 21 Aug. - 21 Nov. 1976
Dale Buhanan, Jim Parch, Joe Wise, Gerhart Zenner, and Bill Armbruster Nov. 1976 58 p
(Contract DAAB07-75-C-0033)
(AD-A038681; QPR-6) Avail: NTIS HC A04/MF A01 CSCL 09/1

Because of the number of integrated circuits processed to date, along with the favorable probe yield results, the 5400 and 54LS processes have been well established. Results on the discrete devices, however, have not been as promising. Additional lots of each device type are being processed in an attempt at further improving yields. Packages for all of the devices have been designed for use in satisfying the qualification test requirements. Author (GRA)

N77-28407# Edgerton, Germeshausen and Grier, Inc., Salem, Mass. Electronic Components Div.
REPETITIVE SERIES INTERRUPTER, 2 Triannual Report, no. 2, 23 May - 31 Dec. 1976
Robert Simon and David V. Turnquist Mar. 1977 47 p refs
(AD-A038557; ECOM-76-1301-2) Avail: NTIS HC A03/MF A01 CSCL 09/1

This report describes work done from May through December, 1976 on the Repetitive Series Interrupter, a hydrogen thyratron modified for switch-opening operation. Parametric studies of tube behavior, particularly of tube voltage drop and current-quenching requirements, are given, with further notes of tube performance and operational characteristics. Experimental modifications are mentioned and proposed continuations of work are discussed. Author (GRA)

N77-28408# Army Electronics Command, Fort Monmouth, N. J.
DESIGN SYMBOLS LIBRARY, A COMBINED DESIGN AND DOCUMENTATION TOOL
Thomas J. Wheeler Dec. 1976 59 p
(AD-A038620; ECOM-4452) Avail: NTIS HC A04/MF A01 CSCL 09/2

Current methods of design of electronic equipment produce documentation after the design, resulting in duplication of cost and inadequate documentation. A system is described which makes use of a Standard Library of design symbols to integrate the design/documentation process, thereby reducing cost and insuring adequacy of documentation. Author (GRA)

N77-28409# Rockwell International Corp., Newport Beach, Calif. Collins Commercial Telecommunications Div.
FABRICATION AND TESTING OF MOS SCALER/LOGIC AND OVERHEAD SAFETY INTEGRATED CIRCUIT Final Report, May 1975 - Mar. 1976
Gerald L. Donaldson May 1976 271 p
(Contract DAAG39-75-C-0146; DA Proj. 1W6-64602-D-454)
(AD-A038513; Rept-765-5608-001; HDL-CR-76-146-1) Avail: NTIS HC A12/MF A01 CSCL 09/5

This report presents the results of the fabrication and test effort of a MOS/LSI integrated circuit used in the XM587E2/XM724 Electronic Time Fuze designed by Harry Diamond Laboratories (HDL). The integrated circuit performs the scaling and overhead safety functions of the fuze system. The device was designed and produced under contract DAAG39-74-C-0161. The MOS-LSI circuit was successfully fabricated and tested to all requirements of contract DAAG39-75-C-0146. One thousand first-article devices and six thousand production devices were successfully qualified and then shipped to HDL. Author (GRA)

N77-28410# Purdue Univ., Lafayette, Ind. Center for Information and Numerical Data Analysis and Synthesis.
THERMOPHYSICAL AND ELECTRONIC PROPERTIES INFORMATION ANALYSIS CENTER (TEPIAC): A CONTINUING SYSTEMATIC PROGRAM ON TABLES OF THERMOPHYSICAL AND ELECTRONIC PROPERTIES OF MATERIALS Final Report, 1 Oct. 1975 - 31 Dec. 1976
Cho Yen Ho Feb. 1977 67 p
(Contract DSA900-76-C-0860)
(AD-A038198; AMMRC-CTR-77-7) Avail: NTIS HC A04/MF A01 CSCL 20/12

This Final Report describes the activities and accomplishments of the Thermophysical and Electronic Properties Information Analysis Center (TEPIAC) in the period 1 October 1975 to 31 December 1976. TEPIAC's activities reported herein include literature search, acquisition, and input of source information; document review and codification and substance classification; operation of a computerized information storage and retrieval system; preparation and publication of the Thermophysical Properties Research Literature Retrieval Guide Supplement; data extraction and compilation; data evaluation, correlation, analysis, synthesis, and generation of recommended values; preparation and publication of the Thermophysical Properties of Matter - The TPRC Data Series, state-of-the-art reports, and critical reviews; technical and bibliographic inquiry services; and current awareness and promotion efforts. TEPIAC covers 14 thermophysical properties and 22 electronic (including also electrical, magnetic, and optical) properties and property groups of nearly all materials at all temperatures. GRA

N77-28411# Princeton Univ., N. J. Dept. of Electrical Engineering.
STUDY OF ELECTRONIC TRANSPORT AND BREAKDOWN IN THIN INSULATING FILMS Semiannual Technical Report
Walter C. Johnson 1 Dec. 1976 70 p refs
(Contract DAAG53-76-C-0059; DARPA Order 2182)
(AD-A038085; NVL-0059-003; SATR-2) Avail: NTIS HC A04/MF A01 CSCL 20/3

Recent progress is reported on an ongoing program of studies of high-field electronic injection, transport, trapping, and dielectric breakdown in thin insulating films. The studies include the use of combined corona and optical techniques for the investigation

of carrier injection, transport, and trapping; a study of the charge-carrier recombination properties of SiO2 and the Si-SiO2 interface; an investigation of the high-field generation of electron traps in MOS structures; a study of high-field breakdown effects in aluminum oxide; and an investigation of electron-beam-induced interface states in the Si-SiO2 system. Author (GRA)

N77-28412# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ON THE PHENOMENON OF CURRENT PULSES GENERATED BY CONDUCTORS NEAR CONTACT IN ELECTRIC FIELDS Final Report
William Bucher Dec. 1976 19 p
(DA Proj. 1L6-62618-AH-80)
(AD-A038048; BRL-1951) Avail: NTIS HC A02/MF A01 CSCL 20/3

The generation of current pulses in external circuitry by neutral and charged conductors near contact in electric fields is described. Theoretical predictions are presented for various configurations of fields and conductors. The results are directly applicable to both the detection of conducting particles and conductor linkage. Author (GRA)

N77-28413# Purdue Univ., Lafayette, Ind.
THE EFFECTS OF SUBSTRATE COMPOSITION OF THICK FILM CIRCUIT RELIABILITY Final Report, 1 Feb. 1976 - 31 Jan. 1977
R. W. Vest 28 Feb. 1977 70 p refs
(Contract N00019-76-C-0354)
(AD-A038340) Avail: NTIS HC A04/MF A01 CSCL 20/12

Studies of the rate of the dissolution of 96% Al2O3 substrates (AlSiMag 614) in a model glass (70% PbO, 20% B2O3, 10% SiO2) were conducted as a function of temperature from 750 to 1000 C. The rate limiting steps were found to be phase boundary reaction rate control at short times and diffusion through a boundary layer under natural convection at longer times. The rate equations developed from the experimental data allow the prediction of the total quantity of substrate dissolved in the resistor glass under any processing conditions. GRA

N77-28414# National Bureau of Standards, Washington, D. C. Inst. for Basic Standards.
RADIATION-HARDNESS TESTING OF ELECTRONIC DEVICES: A STUDY OF FACILITY DOSIMETRY PRACTICES Final Report, Jan. - Sep. 1976
J. C. Humphreys and S. E. Chappell Sep. 1976 45 p refs
(AD-A036669; NBSIR-76-1135) Avail: NTIS HC A03/MF A01 CSCL 09/1

As part of a program to develop better quality assurance in the measurement of total dose in the field of radiation-hardness testing of electronic devices, a survey was conducted at twelve radiation test facilities. The survey was carried out through personal visits during which various characteristics of the test facilities and dosimetry procedures were noted. This report summarizes the results of the survey. Particular attention is given to the types of dosimetry problems perceived by the dosimetry personnel at the facilities as well as to general observations by the surveyor. The observations and information obtained through this survey led to some conclusions on where problems in total-dose measurements may occur. Some specific recommendations result and give direction to the program plan for developing more consistent measurement procedures within the radiation-hardness testing community. Author (GRA)

N77-28415# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
STUDY OF THE SWITCHING MECHANISM IN BISTABLE AMPLIFIERS WITH APPLICATION TO THEIR DEVELOPMENT, OPTIMIZATION AND CONSTRUCTION Final Technical Report, Nov. 1975 - Nov. 1976
M. Carbonaro Nov. 1976 173 p refs
(Grant DA-ERO-75-G-073; DA Proj. 1T1-61102-B-35E)
(AD-A036266) Avail: NTIS HC A08/MF A01 CSCL 09/5

A detailed experimental and theoretical study of the flow field in the interaction region of a fluidic wall-attachment amplifier was made. Velocity profiles were measured using a laser Doppler velocimeter. A mathematical model of the flow was also established, using an integral method. Reasonable agreement between theory and experiments was obtained. As a continuation of previous work, the design of two bistable amplifiers, operating respectively with turbulent and with laminar flow, was optimized. A simplified chemical etching technique was established for the manufacture of such fluidic elements. Author (GRA)

N77-28416# RCA Labs., Princeton, N. J.
ENHANCEMENT MODE TRANSFERRED-ELECTRON LOGIC DEVICES (TELDs) Final Report, 1 Dec. 1975 - 30 Nov. 1976
L. C. Upadhyayula, R. E. Smith, and J. F. Wilhelm Dec. 1976 39 p refs
(Contract N00014-76-C-0464; RF54582001)
(AD-A036358; PRRL-76-CR-59) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report describes the results of the quasi-enhancement mode transferred-electron logic program which was intended to develop GaAs devices suitable for this mode of operation and evaluate them in pulse amplifier circuits. Epitaxial GaAs wafers were grown by vapor hydride synthesis. Electrolytic etching of the wafers was used to obtain uniform nd product across the wafers. Quasi-enhancement mode devices were fabricated and dc, rf, and switching parameters were characterized. Current drop of the order of 10-15% was measured. Trigger sensitivity of these devices was 1.5-2.5 V. The quality of the epi-layer substrate has to be further improved so that lower nd product can be used; this will improve the trigger sensitivity and reduce device dissipation. A TELD-FET circuit evaluated as a pulse amplifier was found to provide voltage gain with good trigger sensitivity and high-frequency response. This configuration combines the advantages of FETs (good trigger sensitivity) and TELDs (threshold and neuristor) and is potentially very useful for ultrahigh-speed logic. Voltage gains of up to 4 were realized for about 100-ps pulse width (half-height) operation. Author (GRA)

N77-28417# Illinois Univ., Urbana-Champaign. Coordinated Science Labs.
MOS TRANSISTOR DRIVERS FOR LARGE CAPACITIVE LOADS M.S. Thesis
Paul Fielding Smith Oct. 1976 62 p refs
(AD-A036362; R-748) Avail: NTIS HC A04/MF A01 CSCL 09/1

The advent of MOS large-scale integration (LSI) has focused considerable research activity into studying the compromises involved in efficient integrated circuit design. These trade-offs may involve circuit size, device parameters, circuit speed, and extra processing steps. Available chip size, manufacturing tolerance, and cost place upper and lower limits on the range each of these can take. There may also be some concern about requiring several voltage sources or complicated clocking sequences which cannot be derived on the chip. Author (GRA)

N77-28418# Varian Associates, San Carlos, Calif. EIMAC Div.
MANUFACTURING METHODS AND TECHNOLOGY (MMTE) MEASURE FOR FABRICATION OF LOW VOLTAGE START SEALED BEAM ARC LAMPS Quarterly Progress Report, 1 Jun. - 31 Aug. 1976
Edwin T. Chan and Gordon E. Liljegren Sep. 1976 36 p
(Contract DAAB07-76-C-0034)
(AD-A036189; QPR-1) Avail: NTIS HC A03/MF A01 CSCL 13/1

A program is in progress to establish a production capability for the purpose of meeting estimated military needs for the X6335, a 1-kw sealed beam xenon arc lamp with low voltage starting mechanism. Parts for five (5) lamps were fabricated. These parts were ordered for the First Engineering Sample Phase of the contract. Lamp part drawings are complete for the First Engineering Sample. Short run welding and brazing fixtures have been fabricated. A reflector mandrel has been machined and polished. Author (GRA)

N77-28419# Defense Intelligence Agency, Washington, D.C.
ELECTRIC VEHICLE RESEARCH, DEVELOPMENT AND TECHNOLOGY - FOREIGN
James D. Busi Apr. 1976 72 p ref Amendment A to DST-1850S-403-75
(AD-A036458; DST-1850S-403A-75) Avail: NTIS

HC A04/MF A01 CSCL 13/6

Current research efforts and a computer analysis of foreign electrochemical traction battery technology utilizing various standardization and simulation techniques support the following ranking of foreign electric vehicle technology: United States, United Kingdom; Japan; Federal Republic of Germany; U.S.S.R.; France; Italy; and Sweden. All-electric vehicle systems (battery-battery or battery-fuel cells) are not presently competitive, on an energy or power density basis, with conventional, fossil-fueled, internal combustion engine systems. All-electric vehicle systems, however, offer an alternate or complementary mode of transportation in major metropolitan areas by reducing atmospheric pollution and fossil fuel consumption. Advanced lead-acid, nickel-iron, and nickel-zinc traction batteries offer the greatest promise for urban transit vehicles(city buses, microbuses, and commuter cars). Commercial application of these electrochemical propulsion systems will receive considerable government and public support over the next 10 years in Europe, Japan, and the U.S.S.R. High-energy electrochemical propulsion systems such as the sodium-sulfur, lithium-sulfur, and metal-air traction battery systems are theoretically promising. Actual utilization of these power sources in small military and domestic vehicles is anticipated by the late 1980s. GRA

N77-28420# National Bureau of Standards, Washington, D. C. Electronic Technology Div.

SEMICONDUCTOR MEASUREMENT TECHNOLOGY Progress Report, 1 Jan. - 30 Jun. 1976

W. Murray Bullis Apr. 1977 123 p refs Sponsored in part by DNA, SAMSO, and the Navy Strategic Systems Projects Office

(Contract E(49-1)-3300; ARPA Order 2397)

(PB-265302/0; NBS-SP-400-29) Avail: NTIS HC A06/MF A01 CSCL 09A

The following are discussed: materials characterization by electrical methods; materials characterization by physical analysis methods; materials and procedures for wafer processing; photolithography; test patterns; assembly and packaging; and device inspection and test. GRA

N77-28421# Burndy Corp., Norwalk, Conn.

DEVELOPMENT OF A CRIMP CONNECTOR FOR TRAILING CABLE SPLICES Final Report

Walter J. Frank, Jr. Dec. 1976 89 p

(Contract DI-BM-HO-357100)

(PB-266027/2; BM-OFR-58-77) Avail: NTIS HC A05/MF A01 CSCL 09A

The major effort is a connector design parameter study. Utilizing the optimum parameters developed along with the suggested design procedure outlined in appendix 1 should result in significantly improved splice performance and thus meet the objectives. A field test program was instituted to insure the adaptability of connector design and associated installation tooling along with a field performance study. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N77-28422 Colorado Univ., Boulder.

MASS TRANSPORT THROUGH SYNTHETIC MEMBRANES USING A MODIFIED RAYLEIGH INTERFEROMETER Ph.D. Thesis

Michael Charles Mickley 1976 256 p

Avail: Univ. Microfilms Order No. 77-3204

The purposes of this study were to determine the applicability of the modified Rayleigh interferometer to obtain membrane transport data on both thick and thin membranes, and to develop the flux/driving force relationships necessary to describe mass transport in membranes. The transport of binary sucrose/water solutions through thin G.E. Nucleopore and thick Schleicher and Schuell membranes was studied at 25 C. The one-dimensional transient diffusion process generated a transient interference pattern which was photographed at several times. The photographed interference patterns provided concentration profile information at each time. Analysis of this basic data provided concentration and flux information to within ten microns of the membrane surface. Dissert. Abstr.

N77-28423 Iowa Univ., Iowa City.

THERMAL DIFFUSION THROUGH A PERIODICALLY LAMINATED HALF-SPACE Ph.D. Thesis

Abdel-Salam Mohamed Abdallah 1976 215 p

Avail: Univ. Microfilms Order No. 76-26260

The problem of thermal diffusion through a half space consisting of alternating laminates of two homogeneous isotropic materials subject to a general linear boundary condition at the free surface is considered. The technique of Fourier exponential integral transform from the time domain to the frequency domain is combined with a theorem by Floquet to obtain an exact closed form solution of the transient temperature distribution in integral form. To illustrate the usefulness of the solution, an important application which occurs frequently in the field of aerodynamics with a specific boundary condition is analyzed and a numerical evaluation of the solution for selected values of parameters is obtained. A comparative study of the classical problem of thermal diffusion in a homogeneous half-space is also included. Dissert. Abstr.

N77-28424 Cincinnati Univ., Ohio.

A STUDY OF PLANE TURBULENT COUETTE FLOW COUPLED WITH PRESSURE GRADIENT Ph.D. Thesis

Augustine Chi-Fung Cheung 1976 277 p

Avail: Univ. Microfilms Order No. 77-4013

The flow in a rectangular channel having one moveable wall was studied. Velocity, pressure, and turbulence properties were measured. A blower was attached to the apparatus in order to supply a pressure flow. The conditions ranged from U sub w = 0 to 65 fps (U sub w = velocity of the moving wall) and from U sub w/U sub 0 = 0 to 4.65 (U sub 0 = mean inlet velocity). Velocity profile and pressure development were predicted via numerical methods using approximate boundary layer theories in both the laminar and turbulent situations. In the turbulent flow case Reichardt's eddy viscosity model was employed. Transition from laminar to turbulent boundary layer was assumed to be gradual. Good agreement was shown between prediction and experimental results for the flows tested. For laminar flow the entrance length was estimated to be .04 to .08 times the Reynolds number. In turbulent flow the entrance length was found to be approximately fifty channel widths. Dissert. Abstr.

N77-28425 Tennessee Univ., Knoxville.

AN ANALYSIS BY THE GREEN'S FUNCTION METHOD FOR FLOW OVER AXISYMMETRIC BODIES INCLUDING THE TRANSVERSE CURVATURE EFFECT Ph.D. Thesis

You-Li Chou 1976 173 p

Avail: Univ. Microfilms Order No. 77-3621

Boundary layer equations for two dimensional and axisymmetric flow are investigated. By using the Boussinesq's eddy-viscosity and mean velocity distribution concepts, the Reynolds shear stress term is modeled to be similar to the viscous shear stress in the laminar flow. The Mangler-Levey-Lees transformation provided an almost two-dimensional model for axisymmetric flow and also absorbed the compressibility into the coordinate transformation. The governing equations are written in general compact form for calculating the incompressible and compressible flow behaviors of both laminar and turbulent flows for both the two dimensional and the axisymmetric cases. The partial differential equations are first recast as the ordinary differential equations and then by appeal to Green's theorem are rewritten as a nonlinear integral equation at each successive streamwise station. The sequence of integral equations is solved by iteration. Dissert. Abstr.

N77-28426 Purdue Univ., Lafayette, Ind.

GAS FILM COOLING OF A MODELED HIGH PRESSURE, HIGH TEMPERATURE TURBINE VANE WITH INJECTION IN THE LEADING EDGE REGION FROM A SINGLE ROW OF SPANWISE ANGLED COOLANT HOLES Ph.D. Thesis

Gary Joseph Hanus 1976 346 p

Avail: Univ. Microfilms Order No. 77-1723

An experimental film cooling study was conducted on a 3X size model turbine vane. Injection at the leading edge was from a single row of holes angled in a spanwise direction for two configurations of holes at 18 deg or 35 deg to the surface. The reduction in the local Stanton number for injection at a coolant to-mainstream density ratio of 2.18 was determined from heat flux measurements downstream of injection. Results indicate that optimum cooling occurs near a coolant-to-mainstream velocity ratio of 0.5. Shallow injection angles appear to be most beneficial when injecting into a highly accelerated mainstream. Dissert. Abstr.

N77-28427 West Virginia Univ., Morgantown.
PULSATING FLOW OF AN INCOMPRESSIBLE FLUID THROUGH A SHARP-EDGED ORIFICE METER Ph.D. Thesis
Michael Timothy Pellegrin 1976 354 p
Avail: Univ. Microfilms Order No. 77-2572

The differential pressure-flow relationship for sharp-edged orifice meters subjected to pulsating incompressible flow was investigated experimentally and analytically. Concentric orifices with diameter ratios of 0.35, 0.50, and 0.70 and constructed to ASME specifications were tested using water in a 4 inch diameter pipe. Mean metering run Reynolds numbers were varied between 8 x 1000 and 2.4 x 10000. Most of the testing was performed with nominal pulsation frequencies of 2.8 and 6.5 Hz and rms flow pulsation amplitudes apparatus mounted downstream of the orifice provided the pulsations. Pulsation amplitudes and waveforms were frequency-dependent. Corresponding tests were conducted for steady flow conditions. Dissert. Abstr.

N77-28428 State Univ. of New York, Buffalo.
THE NUMERICAL CALCULATION OF BUOYANCY DRIVEN FLOWS Ph.D. Thesis
Ovid Augustus Plumb 1976 166 p
Avail: Univ. Microfilms Order No. 77-3573

Three general classes of buoyancy driven flows were investigated numerically. These include laminar boundary layers, laminar internal flows, and turbulent boundary layers. All three classes were calculated using the Patankar Spalding finite difference technique. In addition, a two dimensional upwind differencing technique was applied to the internal flow considered. Some experimental work was done with respect to the internal flow to verify the numerical results. Dissert. Abstr.

N77-28429 Purdue Univ., Lafayette, Ind.
MEASUREMENT AND CORRELATION OF REYNOLDS STRESSES IN A CONICAL DIFFUSER Ph.D. Thesis
Edwin George Wiggins 1976 125 p
Avail: Univ. Microfilms Order No. 77-1796

In an attempt to aid the search for a universal turbulent shear stress relation, the mean and turbulent characteristics have been mapped for the boundary layer on the wall of a conical diffuser of 4 degree total divergence angle and length to inlet radius ratio of 16. Mean velocity profiles and profiles of turbulent shear and normal stresses were obtained. Five turbulent shear stress models were examined for their success in predicing the measured profiles. Two models predict the entire shear stress profile; the Cebeci eddy viscosity model is more successful than the Spalding mixing length model. Dissert. Abstr.

N77-28430*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
EFFECT OF TRANSIENT LIQUID FLOW ON RETENTION CHARACTERISTICS OF SCREEN ACQUISITION SYSTEMS Final Report, Jun. 1975 - Mar. 1977
E. C. Cady Apr. 1977 206 p
(Contract NAS3-19719)
(NASA-CR-135218; MDC-G6742) Avail: NTIS HC A01/MF A01 CSCL 20D

A design analysis, is developed based on experimental data, to predict the effects of transient flow and pressure surges (caused either by valve or pump operation, or by boiling of liquids in warm lines) on the retention performance of screen acquisition systems. A survey of screen liquid acquisition system applications was performed to determine appropriate system environment and classification. A screen model was developed which assumed that the screen device was a uniformly distributed composite orthotropic structure, and which accounted for liquid inflow/outflow, gas ingestion quality, screen stress, and liquid spill. A series of 177 tests using 13 specimens (5 screen meshes, 4 screen device construction/backup methods, and 2 orientations) with three test fluids (isopropyl alcohol, Freon 114, and LH2) provided data which verified important features of the screen model and resulted in a design tool which could accurately predict the transient startup performance acquisition devices. Author

N77-28431*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TWO PHASE CHOKE FLOW IN TUBES WITH VERY LARGE L/D
R. C. Hendricks and R. J. Simoneau Aug. 1977 23 p refs Presented at the 1977 Cryog. Eng. Conf., Boulder, Colo., 2-5 Aug. 1977; sponsored by NBS
(NASA-TM-73726; E-9279) Avail: NTIS HC A02/MF A01 CSCL 20D

Data were obtained for two phase and gaseous choked flow nitrogen in a long constant area duct of 16200 L/D with a diverging diffuser attached to the exit. Flow rate data were taken along five isotherms (reduced temperature of 0.81, 0.96, 1.06, 1.12, and 2.34) for reduced pressures to 3. The flow rate data were mapped in the usual manner using stagnation conditions at the inlet mixing chamber upstream of the entrance length. The results are predictable by a two phase homogeneous equilibrium choking flow model which includes wall friction. A simplified theory which in essence decouples the long tube region from the high acceleration choking region also appears to predict the data resonably well, but about 15 percent low. Author

N77-28432# Lockheed Missiles and Space Co., Palo Alto, Calif.
INTERACTION OF A NONSTATIONARY PRESSURE WAVE WITH A SYSTEM OF TWO SPHERICAL SHELLS
A. E. Babaev and V. D. Kubenko 1977 7 p refs Transl. into ENGLISH from Izv. AN SSSR, Mekhan. Tverd. Tela. (Moscow), no. 2, 1977 p 135-141
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Ill. 60616

The transients originating under the effect of a plane pressure wave on a system of two elastic, centrally symmetric, spherical shells are investigated here. The approximate solution of an analogous problem for two coaxial cylindrical shells is given. Author

N77-28433# Lockheed Missiles and Space Co., Palo Alto, Calif.
NONSTATIONARY PROBLEM OF HEAT TRANSFER IN LAMINAR VACUUM INSULATION
I. S. Zhitomirskii, A. M. Kislov, and V. G. Romanenko [1977] 8 p refs Transl. into ENGLISH from Inzh.-Fizich. Zh. (Minsk), v. 32, no. 6, 1977 p 806-813
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Ill. 60616

A mathematical model is proposed for the nonstationary heat and mass transfer in multilayered insulation for the case of transverse evacuation of the packet. Results of numerical computations of the gas pressure, the screen temperature, and the heat flux in the packet are presented for some variations of the insulation. Author

N77-28434# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE QUESTION OF HEAT AND MASS TRANSFER IN LAMINAR-VACUUM INSULATION
R. S. Mikhalchenko and N. P. Pershin 1977 9 p refs Transl. into ENGLISH from Inzh.-Fizich. Zh. (Minsk), v. 32, no. 5, 1977 p 814-821
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Ill. 60616

Nonstationary heat and mass transfer in laminar vacuum insulations is investigated experimentally and theoretically in application to their operating conditions on cryogenic vessels. Author

N77-28435*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMALLY DRIVEN OSCILLATIONS AND WAVE MOTION OF A LIQUID DROP

K. J. Baumeister, R. C. Hendricks, and G. J. Schoessow Aug. 1977 12 p refs Presented at Natl. Heat Transfer Conf., Salt Lake City, Utah, 14-17 Aug. 1977; sponsored by Am. Inst. of Chem. Engineers
(NASA-TM-X-73625; E-9117) Avail: NTIS HC A02/MF A01 CSCL 20D

In the state of Leidenfrost boiling, liquid drops are observed to vibrate in a variety of modal patterns. Theories are presented which predict the frequency of oscillation and show that the observed model patterns of drops correspond to the minimum energy oscillatory excitation state. High-speed photographic techniques were used to record these motions and substantiate the theories. An incipient temperature was also found for water drops in film boiling below which free oscillations do not exist. In addition to these oscillations, photographic sequences are presented which show that wave motion can exist along the circumference of the drop. Following the study of free oscillations, the system was mounted on a shaker table and the drop subjected to a range of forced frequencies and accelerations. Author

N77-28436*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ESTIMATING SURFACE TEMPERATURE IN FORCED CONVECTION NUCLEATE BOILING: A SIMPLIFIED METHOD
R. C. Hendricks and S. S. Papell Aug. 1977 8 p refs Presented at 1977 Cryogenic Engr. Conf., Boulder, Colo., 2-5 Aug. 1977; sponsored by NBS
(NASA-TM-X-73688; E-9223) Avail: NTIS HC A02/MF A01 CSCL 20D

During a test program to investigate low-cycle thermal fatigue, 21 of 22 cylindrical test sections of a cylindrical rocket thrust chamber were thermally cycled to failure. Cylinder liners were fabricated from OFHC copper, Amzirc, and NARloy-Z. The cylinders were fabricated by milling cooling channels into the liner and closing out the backside with electrodeposited copper. The tests were conducted at a chamber pressure of 4.14 MN/sq m (600 psia) and an oxidant-fuel ratio of 6.0 using hydrogen-oxygen as propellants. The average throat heat flux was 54 MW/sq m (33 Btu/sq in./sec). All of the failures were characterized by a thinning of the cooling channel wall and eventual failure by tensile rupture. The 1/2-hard Amzirc material showed little improvement in cyclic life when compared with OFHC copper; while the NARloy-Z and aged Amzirc materials had the best cyclic life characteristics. One OFHC copper cylinder was thermall cycled 2044 times at a steady-state hot-gas-side wall temperature of 514 K (925 R) without failing. Author

N77-28437# Aeronautical Research Council, London (England).
SYSTEMS OF COORDINATES SUITABLE FOR THE NUMERICAL CALCULATION OF THREE-DIMENSIONAL FLOW FIELDS
K. W. Mangler and J. C. Murray (Southampton Univ., Engl.) 1975 73 p refs Supersedes RAE-TR-73074 and ARC-34955 (ARC-CP-1325; RAE-TR-73074; ARC-34955; ISBN-011-470935-1) Avail: NTIS HC A04/MF A01; HMSO £2.30; PHI

Tensor analysis is used to show that in three-dimensional flow problems certain integrability conditions can be used to calculate three families of coordinate surfaces, one of which contains the surface of a given body shape. Two cases are considered in some detail, one suitable for wings of finite aspect ratio and one suitable for swept wings of infinite aspect ratio. The latter case is also of mathematical interest, since the theory of complex functions is used to calculate the coordinate surfaces for a given body shape. Author

N77-28438# Aeronautical Research Council, London (England).
A TIME MARCHING METHOD FOR TWO-AND THREE-DIMENSIONAL BLADE TO BLADE FLOWS
J. D. Denton (Central Electricity Generating Board, London) 1975 25 p refs Supresedes ARC-35567
(ARC-R/M-3775; ARC-35567; ISBN-0-11-470920-3) Avail: NTIS HC A02/MF A01; HMSO £2.30; PHI

A new type of time marching method is described that enables two-dimensional solutions for shock-free blade-to-blade flows to be obtained in computer times comparable to the fastest existing methods. The speed and simplicity of the method enable it to be extended to three-dimensional blade-to-blade flows where no transonic method is believed to be available. Author

N77-28439# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
PRESSURE MEASUREMENTS AT THE FOCUS OF COMBUSTION-DRIVEN IMPLOSIONS
B. Vasudevan Apr. 1977 92 p refs
(UTIAS-TN-209; CN-ISSN-0082-5263) Avail: NTIS HC A05/MF A01

Gaseous mixtures of stoichiometric hydrogen and oxygen were detonated using exploding wires. Extended records from a PCB 119M08, 6.3 mm dia piezoelectric pressure transducer gave detailed pressure-time histories of initial and subsequent implosions. The critical dilution index represents the amount of helium or hydrogen at which the present ignition system failed to produce a detonation wave. A numerical analysis of off-center implosions predicted the decrease of average pressures. The actual location of the focal point was determined by taking imprints of implosions on lead witness plates placed at the origin. The imprints were sharp and well-focused. A maximum degree of off-centeredness of about 3/4 mm from the origin, resulted in a reduction of only about 2% in average pressures. Author

N77-28440# Cambridge Univ. (England). Dept. of Engineering.
A NOTE ON COMPRESSOR EXIT STATIC PRESSURE MALDISTRIBUTIONS IN ASYMMETRIC FLOW
E. M. Greitzer 1976 18 p refs
(CUED/A-Turbo/TR-79) Avail: NTIS HC A02/MF A01

Conditions were examined in which a static pressure maldistribution existed at the exit of an axial flow compressor. It was shown that, contrary to what was often assumed, the exit static pressure could be substantially nonuniform whenever there was a velocity maldistribution which was unsteady relative to the last blade row of the compressor. This occurred for example, in the case of a rotor moving through a steady circumferential maldistribution. A physical explanation is given for the existence of this nonuniformity in static pressure as well as the phase relationship between velocity and pressure maldistributions. Author

N77-28441# Cambridge Univ. (England). Dept. of Engineering.
STABILITY THEORY OF TIME-MARCHING METHODS
S. M. Richardson 1976 20 p refs Sponsored by Rolls-Royce Ltd.
(CUED/A-Turbo/TR-81) Avail: NTIS HC A02/MF A01

A relatively straightforward method for obtaining the local stability properties of multi-variable time-marching schemes for predicting compressible flows is developed. Applications of the method to several one-, two-, and three-dimensional examples are presented. An extension of the techniques used in the stability analysis to the prediction of ill-conditioning of steady state methods, in particular near sonic conditions, is also developed, and examples are given which show how to overcome the ill-conditioning problems. Author

N77-28442# Cambridge Univ. (England). Dept. of Engineering.
ECKARDT'S IMPELLER: A GHOST FROM AGES PAST
J. Moore 1976 22 p refs
(CUED/A-Turbo/TR-83) Avail: NTIS HC A02/MF A01

Equations are presented which give an approximate representation of blade camber line profiles and of hub and shroud profiles of Eckardt's impeller. Also presented are equations describing the correpsonding profiles of a centrifugal impeller used in the De Havilland Ghost engine. It is found that both impellers were designed with elliptical blade camber line profiles and circular arc hub and shroud profiles and the geometries of the two impellers are consequently of the same family. Author

N77-28443# Argonne National Lab., Ill.
FINITE AMPLITUDE THERMAL CONVECTION IN POROUS MEDIA WITH UNIFORM HEAT SOURCE
I. T. Hwang 1976 9 p refs Presented at the Natl. Heat Transfer Conf., St. Louis, 8-11 Aug. 1975
(Contract W-31-109-eng-38)

(CONF-760816-10) Avail: NTIS HC A02/MF A01

An unbounded horizontal fluid layer in a porous medium with an internal heat source and uniformly heated from below was studied. The layer is in the gravitational field. Linear theory predicts that the disturbances of infinitesimal amplitude will start to grow when the Rayleigh number exceeds its critical value. These disturbances do not grow without limit; but by advecting heat and momentum, the disturbances alter their forms to achieve a finite amplitude. Just like infinitesimal amplitude disturbances the degeneracies of possible solutions persist for finite amplitude solutions. This study evaluates the stability of these various forms of solutions. The small parameter method of Poincare is used to treat the problem in successive order. ERA

N77-28444# Aerojet Nuclear Co., Idaho Falls, Idaho. Idaho Engineering Lab.

NUMERICAL METHODS FOR SOLVING THE GOVERNING EQUATIONS FOR A SERIATED CONTINUUM

R. E. Narum, C. Noble, G. A. Mortensen, and J. H. McFadden Sep. 1976 37 p refs

(Contract E(10-1)-1375)

(ANCR-NUREG-1340) Avail: NTIS HC A03/MF A01

The finite difference forms of a set of equations governing a seriated continuum are presented along with two methods developed for solving the resulting systems of simultaneous nonlinear equations. Results from a one-dimensional computer code are presented to illustrate the capabilities of one of the solution methods. ERA

N77-28445# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.

NUMERICAL METHODS FOR INTERACTING BOUNDARY LAYERS Final Report, 1 Oct. 1975 - 30 Sep. 1976

R. T. Davis and M. J. Werle Aug. 1976 25 p refs

(Contracts N00014-76-C-0364; N00014-76-C-0359)

(AD-A038660; AFL-76-8-23) Avail: NTIS HC A02/MF A01 CSCL 20/4

This study is a review of finite difference methods for computing interacting boundary layers for subsonic and supersonic separated flows. Author (GRA)

N77-28446# Honeywell, Inc., Minneapolis, Minn. Government and Aeronautical Products Div.

PRODUCTION SUITABILITY OF AN ELECTROFORM CONDUCTIVE-WAX PROCESS FOR THE MANUFACTURE OF FLUIDIC SYSTEMS Final Report, Mar. - Oct. 1976

Walter Posingies Apr. 1977 96 p refs

(Contract DAAJ02-74-C-0012)

(AD-A038562; USAAMRDL-TR-77-2) Avail: NTIS HC A05/MF A01 CSCL 20/4

This document presents the results of Phase III of a three-phase program to determine and demonstrate the suitability of the electroform conductive-wax process used in conjunction with conventional production process, for the manufacture of fluidic systems. During Phase I, an integrated amplifier-manifold hydrofluidic stability augmentation system using the electroform conductive wax process was successfully designed, fabricated, and qualification tested, and a pilot production line using the electroform conductive wax process was defined. The pilot production line includes all manufacturing, inspection, and assembly equipment necessary to produce the integrated amplifier-manifold hydrofluidic stability augmentation systems. Phase II included the setup and checkout of the pilot production line. Three groups of three systems each were fabricated and tested. Circuit configuration and the production processes were changed as a result of the analysis of each group of components. In this phase, Phase III, a small 'proof' production run was accomplished, using the pilot production line and the revised production process. Component quality was determined through detailed testing of components and systems combined with statistical analysis. A complete definition of the hardware was defined in a separately submitted technical data package. Author (GRA)

N77-28447# Johns Hopkins Univ., Baltimore, Md.

A THEORY OF TURBULENCE IN A HOMOGENEOUS FLUID INDUCED BY AN OSCILLATING GRID

Robert R. Long Feb. 1977 13 p refs

(Contract N00014-75-C-0805)

(AD-A038424; TR-10-SER-C) Avail: NTIS HC A02/MF A01 CSCL 20/4

Recent studies of turbulence indicate that the root-mean-square horizontal velocity sigma (u) is proportional to the oscillation frequency f and is inversely proportional to distance from the grid, and that the integral length scale l is proportional to this distance and independent of f. A theoretical model is based on the Navier-Stokes equations and the no-slip boundary condition but contains no other assumptions. The statistically steady behavior is as observed in the experiment. In the unsteady case, the front separating turbulent and non-turbulent fluid propagates at a speed inversely proportional to the square root of time. The problem has importance with respect to the mixed layer in the upper ocean or in the lower atmosphere. The present model does not consider buoyancy effects but if a passive contaminant is present the mean concentration is governed by the one-dimensional diffusion equation with constant turbulent coefficient of diffusion. GRA

N77-28448# RAND Corp., Santa Monica, Calif.

THE E-9 STABILITY THEORY AND BOUNDARY-LAYER TRANSITION Interim Report

S. A. Berger and J. Aroesty Feb. 1977 40 p refs

(Contract DAHC15-73-C-0181; ARPA Order-189)

(AD-A038908; R-1898-ARPA) Avail: NTIS HC A03/MF A01 CSCL 20/4

Successful low-drag design employs methods of boundary-layer control to delay the transition of unstable laminar boundary layers, but a suitable comprehensive theory is needed to guide prediction and control of boundary-layer transition for low-drag hydrodynamics. This report suggests new and less formal nonlinear theories, which combine the growth rates and frequency dependence of the two-dimensional Tollmien-Schlichting waves (which are the basis of the 'e-9' method) and the three-dimensional nonlinear processes of modern stability theory. These could ultimately lead to improvements in the understanding and manipulation of the transition process in low-drag hydrodynamics, and to the inclusion of disturbance effects. GRA

N77-28449# California Univ., San Diego. Inst. for Pure and Applied Physical Science.

TURBULENCE IN STRATIFIED FLOW AND OCEAN PHYSICS Final Report, Feb. 1976 - Feb. 1977

C. W. VanAtta Mar. 1977 34 p refs

(Contract N00014-76-C-0702; ARPA Order 1910; NR Proj. 062-544)

(AD-A038122) Avail: NTIS HC A03/MF A01 CSCL 20/4

The development of a continuous return stratified flow water tunnel is described, and the major problems are discussed. The goal of this effort is to provide a facility for studying flows with important buoyancy effects occurring in undersea applications and, in many cases, also of importance in fundamental oceanographic problems. The capabilities of the UCSD stratified water tunnel are ideal for investigation of flows with both variable density and velocity profiles. Author (GRA)

N77-28450*# ARO, Inc., Arnold Air Force Station, Tenn.

ROUGHNESS AND WALL TEMPERATURE EFFECTS ON BOUNDARY LAYER TRANSITION ON A 0.0175-SCALE SPACE SHUTTLE ORBITER MODEL TESTED AT MACH NUMBER 8 Final Report

G. D. Wannenwetsch and W. R. Martindale Apr. 1977 40 p refs Sponsored by NASA

(NASA-CR-154114; AD-A038895; ARO-VKF-TR-76-19; AEDC-TR-77-19) Avail: NTIS HC A03/MF A01 CSCL 20/4

Heat-transfer tests were conducted on the Space Shuttle Orbiter Vehicle in the AEDC/VKF Hypersonic Wind Tunnel (B) to determine the location of boundary-layer transition for a simulated reentry phase flight profile. The model was a 0.0175-scale model with simulated randomly misaligned thermal protection system tiles etched into the windward surface. The tests were conducted at a nominal free-stream Mach number of 8, free-stream unit Reynolds numbers ranging from 0.5 million to 3.7 million per ft, and angles of attack of 30, 35, and 40 deg. Values of wall temperature to free-stream stagnation temperature ranged from 0.14 to 0.44. Representative test data and an analysis of the windward surface centerline heat-transfer data are included.

Effects of wall temperature, tile roughness, and angle of attack on the location of transition are discussed. GRA

N77-28451# Ballistic Research Labs., Aberdeen Proving Ground, Md.
AN INTRINSIC DESCRIPTION OF UNSTEADY SHOCK WAVES
Thomas W. Wright Mar. 1977 41 p refs
(AD-A038595; BRL-1971) Avail: NTIS HC A03/MF A01 CSCL 20/4

In this paper the intent is to obtain, insofar as possible, an intrinsic description of shock propagation, that is to say, a description such that the motion and the evolution of the amplitude of the shock are determined by quantities known on the shock itself. Such a description would parallel the results of geometrical acoustics, but with significant differences. GRA

N77-28452# Stanford Univ., Calif. Dept. of Civil Engineering.
WAVE-INDUCED VELOCITIES AND TURBULENT REYNOLDS STRESSES ABOVE AN AIR-WATER INTERFACE
Shen P. Chao, En Y. Hsu, and Robert V. Street Dec. 1976 174 p refs
(Contract N00014-76-C-0155; Grant NSF ENG-73-04190)
(AD-A038361; SU-TR-204) Avail: NTIS HC A08/MF A01 CSCL 08/3

The progressive, sinusoidal water-wave-induced perturbations in a turbulent air flow above an air-water interface were studied. The velocity field was measured both in fixed and wave-following reference frames with a cross hot-film probe. Both the magnitude and phase of the wave-induced velocities and turbulent Reynolds stresses were obtained across the turbulent boundary layer. The calculated results showed that the wave-induced turbulent Reynolds stresses are important in the evaluation of momentum transfer from wind to waves, their contribution comprising about 90 percent of the total transfer, while the critical layer contribution is about 10 percent. GRA

N77-28453# Joint Publications Research Service, Arlington, Va.
HEAT TRANSPORTATION BY HOT WATER PIPE-LINES AT 90 DEG C
J. M. Bourguet, H. Fischer, and L. Lancal Mar. 1977 39 p refs Transl. into ENGLISH from Tech. de l'Energie (France), no. 1, 1976 p 14-18
(AD-A038301; CRREL-TL-576) Avail: NTIS HC A03/MF A01 CSCL 20/13

This report describes the possibility of transporting heat produced by Nuclear Power Plants for urban heating distribution systems by means of water at 90 C. Author (GRA)

N77-28454# Mississippi State Univ., Mississippi State. Engineering Industrial Research Station.
NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR 2D HYDROFOILS Final Report, 1 Apr. 1974 - Dec. 1976
Joe F. Thompson, Samuel P. Shanks, and Ray L. Walker Feb. 1977 82 p refs
(Contract N00014-74-C-0373)
(AD-A038092; MMSU-EIRS-ASE-77-5) Avail: NTIS HC A05/MF A01 CSCL 20/4

This report presents the results of an investigation of the application of numerically-generated boundary-fitted curvilinear coordinate systems in the finite-difference solution of the time-dependent, two-dimensional Navier-Stokes equations for the laminar viscous flow about hydrofoils moving either submerged at a finite depth or in a free surface of a fluid of infinite depth. The hydrofoil may be of arbitrary shape, and its motion may include pitching oscillation or oscillation normal or parallel to the plane of the undisturbed free surface as well as translation parallel to this plane. A computer code has been developed that is capable of predicting the flow field, pressure distributions, and force coefficients for this configuration at low Reynolds numbers. The finite-difference solution is implicit in time so that all the difference equations are solved simultaneously by iteration at each time step. Author (GRA)

N77-28455# Harry Diamond Labs., Adelphi, Md.
A FLUIDIC GENERATOR AS AN ENVIRONMENTAL AND SAFETY DEVICE FOR THE SUU-53/A CARTRIDGE DISPENSER
Carl J. Campagnuolo, Harold S. Duff, Henry C. Lee, Frank E. Blodgett, and Leon Scheintine Mar. 1977 32 p refs
(AD-A038120; HDL-TM-77-1) Avail: NTIS HC A03/MF A01 CSCL 19/1

A fluidic generator, when mounted in an SUU-53/A cartridge dispenser, allows the pilot to fire cartridges only when the aircraft is in flight and has reached a velocity of 170 indicated airspeed in knots (KIAS) for all flight altitudes; below 140 KIAS the device is inoperative; this inoperativeness makes the dispenser safe. The fluidic generator as an environmental safety and arming device was flight tested at subsonic and supersonic speeds and successfully passed all Military Standards qualifications. GRA

N77-28456# Harry Diamond Labs., Adelphi, Md.
FLUERICS 39: THE FLUID MECHANICS OF FLUIDICS
Tadeusz M. Drzewiecki Feb. 1977 27 p refs Presented at the Am. Phys. Soc. 28th Ann. Meeting, Maryland Univ., 25 Nov. 1975
(AD-A038498; HDL-TR-1798) Avail: NTIS HC A03/MF A01 CSCL 13/7

Some of the models of fluidic devices where specific treatment of fluid phenomena is presented are discussed in this paper. By modelling jets in terms of their momentum flux, one can obtain quite accurate results for pressure recovery of fluidic devices wherein the jet is stagnated and turned. Dynamic effects of pneumatic and hydraulic jet flow devices can be modelled by use of lumped parameters concepts such as slug flow and moving jet boundary volumes. These types of analyses are shown to have good agreement with measured characteristics. GRA

N77-28457# Office of the Assistant Chief of Staff for Intelligence, Washington, D. C.
CALCULATION OF TEMPERATURE FIELDS IN CONCRETE HYDRAULIC STRUCTURES
Sh. N. Plyat Apr. 1977 546 p refs Transl. into ENGLISH from Energiya (Moscow), 1974 490 p Prepared for Army Cold Regions Res. and Eng. Lab., Hanover, N. H.
(AD-A038303; CRREL-TL-615) Avail: NTIS HC A23/MF A01 CSCL 11/2

Methods are presented for calculation of the temperature fields in concrete water engineering structures during the period of construction and of use. The book is intended for scientific workers and engineers--hydraulic engineers and hydroelectric power engineers--and may also be useful for teachers and students in these specialty areas. Author (GRA)

N77-28458# Louisiana State Univ., Baton Rouge. Dept. of Petroleum Engineering.
THE SIMULATION OF WHOLE CORE PERMEAMETER FLOW GEOMETRY M.S. Thesis
Louis Oved Chemin, Jr. Aug. 1974 83 p refs
(Contracts DI-14-31-0001-3218; DI-14-31-0001-3818)
(PB-265223/8; W77-05933; OWRT-A-023-LA(3); OWRT-A-032-LA(3)) Avail: NTIS HC A05/MF A01 CSCL 08I

Numerous studies of fluid flow in porous media have shown that sedimentary formations do not always conduct fluids equally well in all directions in the plane of bedding. This characteristic of preferential directions of flow is referred to as anisotropic or directional permeability. Various laboratory techniques have been developed to obtain anisotropic permeability data from core samples. One of the more sophisticated techniques employs an apparatus known as a whole core permeameter. At the present time, however, this permeameter is primarily used to analyze isotropic core whose permeability is not direction sensitive. The necessary analytical description of the flow field within the permeameter has yet to be developed for the case of an anisotropic core. Results are reported of various attempts to simulate this complex flow geometry by means of two different types of mathematical models--a finite element model and an image well and streamline model. GRA

N77-28459# RAND Corp., Santa Monica, Calif.
THE BUOYANCY AND VARIABLE VISCOSITY EFFECTS ON A WATER LAMINAR BOUNDARY LAYER ALONG A HEATED LONGITUDINAL HORIZONTAL CYLINDER

Lun-Shin Yao and Ivan Catton Feb. 1977 34 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189)
(AD-A036377; R-1966-ARPA) Avail: NTIS HC A03/MF A01 CSCL 20/4

Small cross flow is induced in an otherwise axially symmetric laminar boundary layer when a uniform horizontal stream flows along the inner or outer surface of a heated horizontal cylinder. The magnitude of this cross flow depends on the ratio of the Grashof number to the square of the Reynolds number, based on the radius of the cylinder, and in its early stages grows linearly in the downstream direction. The report shows that the variable-viscosity effect can increase the velocity gradient and, hence, stabilize the laminar boundary layer; the cross-flow effect will decrease the velocity gradient and destabilize the laminar boundary layer over the upper half of the cylinder (or the pipe flow). Also, the boundary beyond which the cross-flow effect can overwhelm the variable-viscosity effect has been determined. Author (GRA)

N77-28460# Dayton Univ., Ohio. Research Inst.
STABILITY OF HIGHLY-COOLED COMPRESSIBLE LAMINAR BOUNDARY LAYERS Final Report, 23 Apr. 1974 - 22 Oct. 1976
Louis I. Boehman and Michael C. Mariscalco 22 Oct. 1976 131 p refs
(Contract F33615-74-C-3067)
(AD-A036210; UDRI-TR-76-70; AFFDL-TR-76-148) Avail: NTIS HC A07/MF A01 CSCL 20/4

This report shows that wall cooling can be an effective means of increasing the stability of laminar boundary layer flows. The stability of two general classes of cooled boundary layer flows was investigated: shock tube induced boundary layers, and cooled subsonic steady flow boundary layers (such as that on a cooled aerodynamic surface in free flight or in a wind tunnel). GRA

N77-28461# McDonnell Aircraft Co., St. Louis, Mo.
NUMERICAL SOLUTION OF SUBSONIC VISCOUS-INVISCID INTERACTING FLOWS Final Report, 16 Apr. 1973 - Dec. 1975
August Iverhoff Wright-Patterson AFB, Ohio AFFDL Jul. 1976 112 p refs
(Contract F33615-73-C-4062)
(AD-A036213; AFFDC-TR-76-64) Avail: NTIS HC A06/MF A01 CSCL 20/4

A numerical procedure has been developed which determines steady state solutions of the turbulent two-dimensional Navier-Stokes equations as the asymptotic large-time limit of the full unsteady equations. The formulation is presented for inviscid flow, laminar flow and turbulent flow using an analytic transformation from the physical space around the body to a computational space. Accurate boundary conditions are derived for inviscid and laminar flow. Inviscid flow calculations for several body shapes show convergence to the steady state solution. The formulation for turbulent flow incorporates equations for turbulence energy and dissipation, and uses a law-of-the-wall boundary condition to avoid the need for fine mesh spacing in the laminar sublayer. Results are presented for a symmetric Joukowsky airfoil for complete laminar flow and for laminar flow with transition to turbulence. Author (GRA)

N77-28462# Purdue Univ., Lafayette, Ind. Proj. SQUID Headquarters.
AN EXPERIMENTAL INVESTIGATION OF MIXING IN TWO-DIMENSIONAL TURBULENT SHEAR FLOWS WITH APPLICATIONS TO DIFFUSION-LIMITED CHEMICAL REACTIONS
John Harrison Konrad Dec. 1976 133 p refs Prepared by California Inst. of Technol., Pasadena
(Contracts N00014-75-C-1143; N00014-76-C-0260; NR Proj. 098-038; Proj. SQUID)
(AD-A036349; SQUID-CIT-8-PU) Avail: NTIS HC A07/MF A01 CSCL 20/4

The extent of molecular mixing in several two-dimensional free turbulent shear flows was measured using a concentration probe with a frequency response of 100 kHz and a spatial resolution of 0.1 mm. The flows investigated were (1) a shear layer in which the gases on either side of the layer are of unequal density, (2) a shear layer in which the gases on either side of the layer are of equal density, and (3) a wake in which the gases on either side of the wake are of unequal densities. The extent of mixing was measured as a function of Reynolds number for the first case. It was found that at a critical Reynolds number the extent of molecular mixing sharply increased (25%). Power spectral density curves of the concentration time histories also indicated a marked increase in the high frequency fluctuations above this Reynolds number. A shadowgraph investigation of this phenomenon revealed that three-dimensional Taylor-type vortices whose axes of rotation are basically in the flow direction exist in the flow in addition to the two-dimensional large structures previously observed. These Taylor vortices were found to be unstable above the critical Reynolds number and were producing the increase in molecular mixing. The growth and development of the two-dimensional large structures were found to be basically unaffected by this instability. It is proposed that the fully developed turbulence of shear flows is maintained by a combination of the development of the large structures and of the coupling between the large structures and these unstable Taylor vortices. GRA

N77-28463# Tennessee Univ., Knoxville. Water Resources Research Center.
APPLICATION OF A TRANSIENT FLOW MODEL TO COORDINATE URBAN STORM RUNOFF DATA WITH FLOW IN A RECEIVING RESERVOIR M.S. Thesis
David A. Summers Dec. 1976 46 p refs
(Contract DI-14-34-0001-6044)
(PB-265204/8; W77-05931; OWRT-A-043-TENN(1)) Avail: NTIS HC A03/MF A01 CSCL 13B

The Simulated Open Channel Hydraulics (SOCH) mode, a mathematical transient flow model was applied to an urban storm-water runoff investigation. A method was sought by which the model could be used to coordinate streamflow in Fort Loudoun reservoir with water quality data taken shortly after precipitation events. Several methods of coordinating data and flow were conceived and tested. After encountering several problems in using the SOCH model, it was decided that the best use of the model was to guide sampling by following a single slug of water as it passed through Knoxville into Fort Loudoun reservoir under conditions of runoff. GRA

N77-28464# Physical Electronics Labs., Menlo Park, Calif.
AN ANALYTICAL STUDY OF THE EFFECT OF SURFACE ROUGHNESS ON THE STABILITY OF A HEATED WATER BOUNDARY LAYER Final Report, 22 Apr. - 30 Sep. 1976
Michael A. Kosecoff, Denny R. S. Ko, and Charles L. Merkle Nov. 1976 46 p refs
(Contract N00014-76-C-0967)
(AD-A036386; PDT-76-131) Avail: NTIS HC A03/MF A01 CSCL 20/4

The onset of transition from laminar to turbulent flow in a high Reynolds number, water boundary layer was investigated with emphasis on predicting the global effects of distributed surface roughness on transition. The authors used the results of linear stability theory as an indicator of transition, but, this paper presents only comparisons of the stability results (not actual transition predictions). The effects of surface roughness on transition were induced by means of an existing phenomenological model for the effects of distributed roughness on the mean flow profiles. This model, originally developed for high Mach number, compressible boundary layers, was applied without change to the present incompressible, water boundary-layer environment, and identical values of the required empirical constants were used in both cases. One conclusion obtained from the numerical results is that the presence of favorable pressure gradients and/or surface heating make the boundary layer more susceptible to roughness, not only when compared in terms of the actual roughness height, but also when compared in terms of the roughness height to momentum thickness ratio. When the roughness is sufficiently large, its presence can change the effect of surface heat addition from a strongly stabilizing factor to a strongly destabilizing phenomena. GRA

N77-28465# Naval Ship Research and Development Center, Bethesda, Md. Computation and Mathematics Dept.
PROGRESS IN NUMERICAL FLUID DYNAMICS AT DTNSRDC
Joanna W. Schot Jul. 1976 24 p refs

(AD-A036474; CMD-15-76) Avail: NTIS HC A02/MF A01 CSCL 20/4

This work involves the development of new numerical and computer techniques for solving both viscous and inviscid fluid flow problems. The topics discussed include free surface potential flow, viscous and interacting flows, and fluid-structure interactions. Combinations of spectral, finite-difference, and finite-element methods are employed in the numerical approaches. Applications of these methods to the performance analysis of air-cushion vehicles, conventional ships, rotating plates, and circulation-controlled airfoils are briefly discussed. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N77-28466 Cornell Univ., Ithaca, N.Y.
AN IMAGE DATA COLLECTION SYSTEM FOR ELECTRON MICROSCOPY Ph.D. Thesis
William Carl Goldfarb 1976 261 p
Avail: Univ. Microfilms Order No. 77-8426

As part of the development of an ultrahigh vacuum cryogenic high resolution electron microscope, a computer interfaced in line image data collection system was designed, built and bench tested. This system is made up of a lens coupled single stage intensified vidicon camera interfaced by slow scanning to a small computer. As background to the testing, the relationship between detective quantum efficiency, conversion gain and data collection system noise is explained by use of a simplified model of a generalized EM image data collection system. The bench tests demonstrated the successful functioning of the system as an image data collection and transfer device. By means of a point-by-point decalibration technique the fixed pattern noise of the camera is reduced by more than a factor of 6 to an almost negligible level. The tests also revealed that the system overall conversion gain was not adequate to achieve the goal of a high defective quantum efficiency for image electrons. Dissert. Abstr.

N77-28467*# Old Dominion Univ. Research Foundation, Norfolk, Va. Dept. of Physics and Geophysical Sciences.
THREE FIELD TESTS OF A GAS FILTER CORRELATION RADIOMETER Interim Report
Shirley A. Campbell, Joseph C. Casas, and Estelle P. Condon Jul. 1977 41 p refs
(Grant NsG-1127)
(NASA-CR-153931; TR-PGSTR-AP77-57) Avail: NTIS HC A03/MF A01 CSCL 14B

Test flights to remotely measure nonurban carbon monoxide (CO) concentrations by gas filter correlation radiometry are discussed. The inferred CO concentrations obtained through use of the Gas Filter Correlation Radiometer (GFCR) agreed with independent measurements obtained by gas chromatography air sample bottle analysis to within 20 percent. The equipment flown on board the aircraft, the flight test procedure, the gas chromatograph direct air sampling procedure, and the GFCR data analysis procedure are reported. Author

N77-28468*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF TWO GAS-DILUTION METHODS FOR INSTRUMENT CALIBRATION
Albert Evans, Jr. Jul. 1977 21 p refs
(NASA-TM-73753; E-9287) Avail: NTIS HC A02/MF A01 CSCL 14B

Two gas dilution methods were evaluated for use in the calibration of analytical instruments used in air pollution studies. A dual isotope fluorescence carbon monoxide analyzer was used as the transfer standard. The methods are not new but some modifications are described. The rotary injection gas dilution method was found to be more accurate than the closed loop method. Results by the two methods differed by 5 percent. This could not be accounted for by the random errors in the measurements. The methods avoid the problems associated with pressurized cylinders. Both methods have merit and have found a place in instrument calibration work. Author

N77-28469*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HOLOGRAPHIC FLOW VISUALIZATION AT THE LANGLEY CF4 TUNNEL
Alpheus W. Burner and Raymond E. Midden Jul. 1977 26 p refs
(NASA-TM-74051) Avail: NTIS HC A03/MF A01 CSCL 14E

A holographic flow visualization system was used to obtain shadowgraph, schlieren, and interferograms of the flow field at Langley's hypersonic (Mach 6) CF4 tunnel. The dual hologram technique which was used makes it possible to vary focusing, knife-edge position, and the orientation and spacing of the interference fringes after a tunnel run. The experimental arrangement necessary to produce high quality interferograms is discussed. Typical shadowgraphs, schlieren pictures, and interferograms are presented. Author

N77-28470*# National Aeronautics and Space Administration. Pasadena Office, Calif.
POLYMERIC ELECTROLYTIC HYGROMETER Patent Application
Daniel D. Lawson, inventor (to NASA) (JPL) Filed 21 Dec. 1976 11 p
(Contract NAS7-100)
(NASA-Case-NPO-13948-1; US-Patent-Appl-SN-752748) Avail: NTIS HC A02/MF A01 CSCL 14B

A flow-through electrolytic hygrometer is provided which utilizes a long lasting oxidation-resistant, hollow fiber formed of a persulfonic acid substituted polytetrafluoroethylene having closely spaced noble metal electrodes in contact with the inner and outer surfaces of the fiber. The fiber is disposed within a chamber such that the moisture bearing gas passes in contact with at least one surface of the fiber. The electrodes are connected in series to a dc voltage supply and an ammeter. As the gas passes through the chamber, moisture absorbed into the wall of the fiber is electrolyzed to hydrogen and oxygen by the closely spaced electrodes. The amount of electricity required for electrolysis is proportional to the absorbed moisture and is observed on the ammeter. NASA

N77-28471*# Battelle Columbus Labs., Ohio.
FEASIBILITY INVESTIGATION OF INTEGRATED OPTICS FOURIER TRANSFORM DEVICES Final Report, 10 Feb. 1975 - 30 Sep. 1976
C. M. Verber, D. W. Vahey, V. E. Wood, R. P. Kenan, and N. F. Hartman Washington NASA Jul. 1977 116 p refs
(Contract NAS1-13802)
(NASA-CR-2869) Avail: NTIS HC A06/MF A01 CSCL 14E

The possibility of producing an integrated optics data processing device based upon Fourier transformations or other parallel processing techniques, and the ways in which such techniques may be used to upgrade the performance of present and projected NASA systems were investigated. Activities toward this goal include; (1) production of near-diffraction-limited geodesic lenses in glass waveguides; (2) development of grinding and polishing techniques for the production of geodesic lenses in LiNbO3 waveguides; (3) development of a characterization technique for waveguide lenses; and (4) development of a theory for corrected aspheric geodesic lenses. A holographic subtraction system was devised which should be capable of rapid on-board preprocessing of a large number of parallel data channels. The principle involved is validated in three demonstrations. Author

N77-28472# Army Materials and Mechanics Research Center, Watertown, Mass.
A COMPUTER METHOD FOR THE CALIBRATION OF A PHOTOGRAPHIC EMULSION FOR SPECTROGRAPHIC ANALYSIS Final Report
Bernard H. Strauss Jan. 1977 26 p
(AD-A038836; AMMRC-TR-77-1) Avail: NTIS HC A03/MF A01 CSCL 14/5

A computer method to calibrate emulsion-covered glass plates used to interpret densities of lines for quantitative spectrographic work is reported. This method follows a slightly modified ASTM graphic method, which is also described, and allows one to simply input dark and light data points to establish preliminary and emulsion calibration curves. After the curves are established, by inputting percent transmission data pairs for a known or unknown concentration line and an internal standard line, one obtains the relative intensity. The computer method is used on a Hewlett-Packard Calculator 9830-A and a UNIVAC 1108 time-sharing computer. Programs for both computers are included in this report. Author (GRA)

N77-28473# Kaman Sciences Corp., Colorado Springs, Colo.
AIR BLAST MEASUREMENT TECHNOLOGY Final Report, Oct. 1975 - Sep. 1976
Donald C. Sachs and Eldine Cole Sep. 1976 211 p refs
(Contract DNA001-76-C-0088)
(AD-A038321; K-76-38U(R); DNA-4115F) Avail: NTIS HC A10/MF A01 CSCL 19/4

Primary objectives of the project are to establish a baseline regarding currently available transducers and measurement technology for the study of air blast phenomena. This project represents an effort toward improvements in existing sensors and measurement practices through understanding and dissemination of information as well as a search for techniques to measure parameters that are being measured with limited success or not at all. The study is focused on measurements of air blast parameters associated with peak overpressures above 140 N/sq cm. (200 psi) that are related to HE tests and large-scale explosively-driven shock tubes designed to simulate the air blast effects and environment from a nuclear explosion. GRA

N77-28474# Texas Univ., Austin. Center for Highway Research.
A STUDY OF THE PERFORMANCE OF THE MAYS RIDE METER
Yi Chin Hu, Hugh J. Williamson, and B. Frank McCullough Jan. 1977 77 p refs Sponsored by the Tex. State Dept. of Highways and Public Transportation; Transportation Planning Div., Austin, Tex.
(PB-265753/4; CFHR-3-8-75-177-3) Avail: NTIS HC A05/MF A01 CSCL 13B

A measurement study of road roughness with the Mays ride meter (MRM) is presented. A model is developed to interpret the effects of the long and short waves on the riding quality of the road and used to explain the difference between the serviceability indices obtained from the surface dynamics profilometer and the MRM. In addition, a statistical analysis is used to show the degree to which the repeated runs of the MRM agree with each other. An assessment is then made as to the applicability of the MRM and its limitations. GRA

N77-28475# National Inst. for Occupational Safety and Health, Cincinnati, Ohio. Div. of Physical Sciences and Engineering.
EVALUATION OF PORTABLE, DIRECT-READING HYDROCARBON METERS (FLAME IONIZATION PHOTOIONIZATION, AND INFRARED DETECTORS)
Maurine A. Willey and Charles S. McCammon Apr. 1976 93 p refs
(PB-266439/9; DHEW/PUB/NIOSH-76/166; NIOSH-76/166) Avail: NTIS HC A05/MF A01 CSCL 14B

A market survey was conducted to determine the availability of portable, direct-reading flame ionization detectors for the measurement of organic vapors. Two prototypes, the Wilks Miran 101 infrared analyzer for toluene and the h.nu photoionization meter were included in this study along with four flame ionization instruments. Manufacturers of selected meters were requested to submit a meter for evaluation of its physical and performance characteristics. Optimum use techniques for each meter evaluated are included. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N77-28476 Wisconsin Univ., Madison.
LASER INDUCED FLUORESCENCE LINE NARROWING STUDIES OF PRASEODYMIUM IN LANTHANUM TRIFLUORIDE AND APPLICATION OF PRESSURE SCANNING TO THE TUNING OF A HIGH RESOLUTION DYE LASER Ph.D. Thesis
Robert Flach 1976 123 p
Avail: Univ. Microfilms Order No. 76-25559

Different applications of pulsed tunable dye lasers to solid state spectroscopy are discussed. It is shown that time-resolved fluorescence line narrowing is one of the most suitable and versatile methods to investigate the spectroscopic properties of solids. Investigations included not only the low concentration limit, but also samples of higher concentration. By sampling the fluorescence signal very shortly after the excitation pulse, measurements of homogeneous widths were undertaken. It is shown that the effect of accidental coincidence plays an important role in the analysis of nonresonant linewidths at low temperatures. Also to be considered are differences in the dependence of the excited state energies on the crystal field strength. Dissert. Abstr.

N77-28477# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
SUPERSONIC DIFFUSER RESEARCH Final Report, 1 Jan. 1973 - 31 Dec. 1976
Peter P. Wegener Mar. 1977 8 p refs
(Contract F44620-73-C-0032)
(AD-A038280; AFOSR-77-0367TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

The research concerned a survey of existing literature on supersonic diffusers, and experimental study on pressure recovery of supersonic diffusers in a variety of facilities with a variety of configurations following a contoured Mach Number = 3 nozzle. The nozzle and test section were free of models and the diffusers were either of constant cross section (straight duct), or of variable cross section, and they were generally patterned to be representative of some classes of gasdynamic laser nozzles. The optimum pressure recovery of the operating facility and the minimum pressure recovery required to start supersonic flow at the nozzle end were determined. The facilities used were a small continuous operation supersonic wind tunnel and a Ludwieg tube operating as a blow down wind tunnel with a steady state in the millisecond region. Careful correlation with data from other facilities taken under different circumstances was performed, while a number of the results found were unique to the current investigation. GRA

N77-28478# ARO, Inc., Arnold Air Force Station, Tenn.
LASER VELOCIMETER MEASUREMENTS IN MODERATELY HEATED JET FLOWS Final Report, Jul. 1975 - Jun. 1976
D. O. Barnett and T. V. Giel, Jr. AEDC Apr. 1977 107 p refs
(AD-A038283; ARO-ETF-TR-76-119; AEDC-TR-76-156) Avail: NTIS HC A06/MF A01 CSCL 20/4

Laser velocimeter (LV) measurements are presented for the developing velocity field of a subsonic jet and an underexpanded jet into quiescent air at nominal stagnation temperatures of 500 and 1,000 R. Severe particle lag effects were encountered in the under-expanded jet so that data presentation is limited to the centerline mean axial velocity and probability distributions for exit-to-ambient static pressure ratios of 2 and 4 at axial stations up to 5 nozzle diameters downstream of the nozzle exit. Data were obtained with a two-component, Bragg-diffracted, individual realization system operated in a backscatter mode. Since the flow was unseeded, the measurements relied on naturally occurring flow contaminants to serve as scatter centers for the LV. Particle dynamics calculations for the two flows are used in conjunction with an analysis of the detection characteristics of the system to develop a theoretical limit for the minimum level of turbulence detectable by an LV. GRA

N77-28479# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Advanced Sensors Directorate.
METHOD OF CALCULATION OF TURBULENCE EFFECTS FOR COMPUTER SIMULATION OF LASER SENSOR POINTING JITTER PERFORMANCE

David L. Fried Jun. 1976 17 p
(AD-A038422; RE-CR-77-4) Avail: NTIS HC A02/MF A01 CSCL 17/8

This work calculates (1) the expected laser spot size, (2) a method of developing a propagation conditions parameter related to what an observer might be able to sense, and (3) the power spectrum for angle-of-arrival jitter due to turbulence in the propagation path between the laser spot and the laser sensor optics. GRA

N77-28480# National Bureau of Standards, Washington, D. C. Inst. for Basic Standards.
PROPOSED STANDARDS FOR LADAR SIGNATURES Final Report
B. L. Danielson Apr. 1977 38 p refs
(AD-A038725; NBSIR-77-856) Avail: NTIS HC A03/MF A01 CSCL 17/8

The laser radar (LR) signatures program sponsored by the Ballistic Missile Defense Advanced Technology Center is directed towards employing LR target scattering for the identification and discrimination of threatening objects. The scattered target radiation is usually expressed in terms of various types of laser radar cross sections (LRCS). Unfortunately, in the past there has not been universal agreement on the precise definitions of the LRCS's of interest, nor has there been a common traceable method for calibrating the diverse systems used in measuring experimental values of LRC's. For example, cross section definitions based on radar use can differ by a factor of 4 from definitions based on the optical use of diffuse plates. Polarization is another factor that is not consistently taken into account. This report represents an effort by the National Bureau of Standards (NBS) to encourage the adoption of a common basis for LRCS measurements. GRA

N77-28481# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
THE DESIGN OF A RANGE FINDER FOR A COMPUTER VISION SYSTEM M.S. Thesis
Roderick James Fletcher Oct. 1976 47 p refs
(Contract DAAB07-72-C-0259)
(AD-A036208; R-749-UILU-ENG-76-2237; Avail: NTIS HC A03/MF A01 CSCL 17/8

A computer vision system has been developed at the Coordinated Science Laboratory (CSL) which enables a PDP-10 computer to acquire television pictures in digital form. The television camera is mounted on a platform referred to as the pan-tilt assembly which can be rotated back and forth and tilted up and down. Also on the pan-tilt assembly are a remote controlled zoom lens and a range finder. Everything on the pan-tilt assembly except for the camera is interfaces to a PDP-11/40 minicomputer which can communicate with the PDP-10. Author (GRA)

N77-28482# Stanford Univ., Calif.
RESEARCH STUDIES ON TUNABLE OPTICAL PARAMETRIC OSCILLATORS Final Report, 1 Oct. 1974 - 30 Sep. 1976
Stephen E. Harris and James F. Young Griffiss AFB, N.Y. RADC Dec. 1976 259 p refs
(Contracts F19628-75-C-0046; DAAG29-74-C-0033; AF Proj. 5634)
(AD-A036311; GL-2630; RADC-TR-76-377) Avail: NTIS HC A12/MF A11 CSCL 20/5

The primary goal of this contract is to pursue research studies of tunable optical sources, to develop coherent sources in new spectral regions, and to conceive and to investigate new nonlinear optical devices of interest to the Air Force. During this contract our efforts have been concentrated on two primary projects: experimental studies of possible metal vapor excimer laser systems, and a unique cesium vapor infrared to visible frequency converter for imaging. Early in this program a number of metal vapor excimer laser systems were investigated experimentally with the hope of demonstrating net optical gain. Based on a number of factors, it was hoped that such excimer systems might prove useful as high efficiency, high power density amplifiers or lasers in the visible or near infrared portion of the spectrum. Because of the lack of detailed knowledge of the interatomic potential of such systems, our investigaton was primarily experimental. Na-Ze, Li-Xe, and Na-Na systems were studied, but no net gain was observed in any case. In addition, these experiments revealed a number of severe technical problems related to the construction of high temperature, high pressure cells containing reactive metals. GRA

N77-28483# Frankford Arsenal, Philadelphia, Pa.
EVALUATION OF BARRIER MATERIALS METAL ALLOYS, FIBERS, AND PLATES
John P. Leahy and Emmanuel A. Lucia Jan. 1977 39 p
(DA Proj. 1F2-62205-AH-88)
(AD-A036400; FA-TN-77001) Avail: NTIS HC A03/MF A01 CSCL 11/6

The resistance of various commercially available lightweight materials to CO2 laser damage was examined. Five samples were supplied for laser evaluation: (1) D242, a needle punched and rolled alloy fiber, (2) 304SS stainless steel fibers web sintered and rolled, (3) 430SS, a stainless steel sinter on hard backing, (4) FM515 with Inconel 600 backing, and (5) a graphite woven cloth. A 100 W CO2 laser beam was focused to provide various irradiance levels up to 6.7 KW/sq cm. These samples may be exposed safely at about 20 watts/sq cm. For kilowatt level exposures, dark finished samples are more robust than bright finished samples of the same material. At 6.7 KW/sq cm, all materials are penetrated in less than one second with the exception of 430SS and DH242 wet with water. Author (GRA)

N77-28484# Little (Arthur D.), Inc., Cambridge, Mass.
FEASIBILITY STUDY OF A DIFFERENT CURRENT GROUND FAULT OR LEAKAGE CURRENT SENSOR FOR DIRECT CURRENT OFFTRACK MACHINES Open File Report, Jun. 1974 - Dec. 1976
Robert R. Perron, Peter G. Martin, and Stuart G. Lipoff 9 Dec. 1976 60 p
(Contract DI-BM-HO-242064)
(PB-265320/2; BM-OFR-63-77) Avail: NTIS HC A04/MF A01 CSCL 08I

The results of a study and laboratory evaluation of a Hall-type device, as a sensor for monitoring low-level dc leakage currents in grounding conductors of off-track machines, are described. The report also contains schematic and logic diagrams for a dc ground fault interrupter system using a microprocessor and digital differentiating techniques to detect sudden changes in dc leakage of 15 milliamperes or more, and appropriate logic to give warning signals or trip the load circuit-breaker when leakage becomes excessive. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N77-28485# Royal Aircraft Establishment, Farnborough (England).
FATIGUE STRENGTH OF JOINTS WITH SPECIAL FASTENING SYSTEMS
D. Schuetz and J. J. Gerharz 1977 17 p refs Transl. into ENGLISH of "Schwingfestigkeit von Fuegungen mit Sonderbefestigungselementen", Rept. TM-69/73 Laboratorium fuer Betriebsfestigkeit, Darmstadt, 1973
(RAE-Lib-Trans-1914; BR58073; TM-69-73) Copyright. Avail: PHI

The performance of various special (fatigue resistant) fasteners has been evaluated by testing under variable amplitude loading to an LBF standard spectrum for a transport aircraft wing. The fasteners were tested in three types of joints which had varying degrees of load transfer and additional bending. The report presents the results of the first phase of the test programme. Author

N77-28486* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HYDROSTATIC BEARING SUPPORT Patent
Robert E. Cunningham, inventor (to NASA) Issued 12 Jul. 1977 4 p Filed 2 Mar. 1976 Supersedes N76-19440 (14 - 10, p 1257)
(NASA-Case-LEW-11158-1; US-Patent-4,035,037; US-Patent-Appl-SN-663008; US-Patent-Class-308-5R;

US-Patent-Class-308-9; US-Patent-Class-308-73) Avail: US Patent Office CSCL 13I

A hydrostatic bearing support system is provided which comprises a bearing housing having a polygonally configured outer surface which defines at least three symmetrically disposed working faces and a plurality of pressure plates, each of which is disposed relatively opposite a corresponding working face and spaced therefrom to define a gap therebetween. A hydrostatic support film is created in the gap for supporting the housing in spaced relationship to the pressure plates.

Official Gazette of the U.S. Patent Office

N77-28487* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

PRESSURE MODULATING VALUE Patent

David S. Jacob, inventor (to NASA) (Beckman Instr., Inc. Anaheim, Calif.) Issued 5 Jul. 1977 4 p Filed 26 Jul. 1976 Supersedes N76-29537 (14 - 20, p 2597) Sponsored by NASA

(NASA-Case-MSC-14905-1; US-Patent-4,033,479; US-Patent-Appl-SN-708795; US-Patent-Class-222-61; US-Patent-Class-222-95; US-Patent-Class-128-214F; US-Patent-Class-128-DIG.12) Avail: US Patent Office CSCL 13K

A modulating valve device, operated by fluid pressure in fluid motors to control work pressure, is described.

Official Gazette of the U.S. Patent Office

N77-28488 Cincinnati Univ., Ohio.

THE DYNAMIC STIFFNESS AND DAMPING OF AN EXTERNALLY PRESSURIZED POROUS GAS JOURNAL BEARING UNDER HYBRID OPERATION Ph.D. Thesis

Edward Peter Gargiulo, Jr. 1976 309 p

Avail: Univ. Microfilms Order No. 77-4014

A confirmed mathematical model for the dynamic stiffness and damping characteristics of a porous bearing during hybrid operation was developed. As a result the following goals were accomplished: (1) developed and verified a porous bearing computer model for general steady-state and linearized dynamic characteristics, (2) created and analyzed theoretical bearing performance charts for steady load, flow, and torque and dynamic stiffness and damping characteristics, (3) designed and constructed a test facility to evaluate combined steady and dynamic loading performance of journal bearings; and (4) tested a 2 inch diameter by 2 inch long porous journal bearing to determine its steady load-deflection and flow characteristics and its behavior in response to a dynamic force excitation over a frequency range for several clearances, supply pressures, and speeds.

Dissert. Abstr.

N77-28489 Tennessee Univ., Knoxville.

DEVELOPMENT OF AN AUTOMOBILE BRAKE PERFORMANCE TEST FOR THE DETECTION OF WORN FRICTION MATERIAL Ph.D. Thesis

Ronald Lee Graves 1976 229 p

Avail: Univ. Microfilms Order No. 77-3639

A finite-difference numerical solution to the brake heating problem was developed to study the heating phenomena during braking or during performance testing on a roller brake dynamometer. The accuracy of the solution was verified via comparison with experimental data. Investigation of the friction coefficient (highly dependent on lining temperature) behavior during simulated inertia stops on a roller brake dynamometer, revealed a brake performance parameter which was found to be a function of lining thickness. In-the-field experiments proved that properly monitoring this parameter could provide 95% accuracy in detecting linings with less than 1/32 in. of usable friction material remaining. Dissert. Abstr.

N77-28490 Northwestern Univ., Evanston, Ill.

THERMAL ELASTOHYDRODYNAMIC LUBRICATION OF SPUR GEARS Ph.D. Thesis

Kuan-Lan Wang 1976 191 p

Avail: Univ. Microfilms Order No. 77-1381

An analysis and computer code were developed to predict the variations of dynamic load, surface temperature, as well as the lubricant film thickness along the contacting path during the engagement of a pair of involute spur gears. The dynamic load is assumed to be not influenced by the lubricant film thickness or by the surface temperature, and, therefore is analyzed independently. The analysis of dynamic load includes the effect of gear inertia, the effect of load sharing of adjacent teeth, and the effect of variable tooth stiffnesses which are obtained by a finite-element method. Dissert. Abstr.

N77-28491 Virginia Polytechnic Inst. and State Univ., Blacksburg.

THE PREDICTION OF POLYMER WEAR USING POLYMER MECHANICAL PROPERTIES AND SURFACE CHARACTERIZATION PARAMETERS Ph.D. Thesis

Jeffery Howard Warren 1976 173 p

Avail: Univ. Microfilms Order No. 77-2774

Polymers were slid on rough hard steel surfaces with normal loads which caused full penetration (real and apparent areas equal) and partial penetration (real less than apparent area). Wear data for polyvinylchloride (PVC) and polychlorotrifluorethylene (PCTFE) was obtained on a pin-on-disk machine using neutron activation analysis (NAA). Observations of the wear process were made in the scanning electron microscope (SEM) before, during, and after the wear experiment. It was observed that these polymers along with Nylon 6-6 tend to wear in discrete sites rather than continuous films. At these discrete sites the polymer shears at an angle which is dependent on the mechanical properties of the polymer and on the asperity angle. Dissert. Abstr.

N77-28492*# Industrial Tectonics, Inc., Compton, Calif.

PERFORMANCE TESTS WITH A 4.75 INCH BORE TAPERED-ROLLER BEARINGS AT HIGH SPEEDS Final Report

Hans R. Signer and Stanley I. Pinel May 1977 100 p (Contract NAS3-18017)

(NASA-CR-135190; ITI-P-1250) Avail: NTIS HC A05/MF A01 CSCL 13I

The tapered-roller bearings were tested at speeds to 15,000 rpm which results in a cone-rib tangential velocity of 130 m/sec. (25,500 ft/min). Lubrication was applied either by jets or directly to the cone-rib, augmented with jets. Additional test parameters included thrust loads to 53,400 N (12,000 lbs), radial loads to 26,700 N (6,000 lbs), lubricant flow rates from 1.9 x 0.000 to 15.1 x 0.001 cubic meter/min. (0.5 to 4.0 gpm), and lubricant inlet temperatures of 350 K and 364 K (170 F and 195 F). Temperature distribution, separator speed, and drive-motor power demand were determined as functions of these test parameters. Author

N77-28493*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HIGH-PRESSURE CRYOGENIC SEALS FOR PRESSURE VESSELS

Alvin E. Buggele Jul. 1977 16 p refs Presented at the 6th Intern. High Pressure Conf., Boulder, Colo., 25-29 Jul. 1977; cosponsored by the Assoc. Intern. for Res. and Advan. of High Pressure Sci. and Technol. and the Intern. Union of Pure and Appl. Chem.

(NASA-TM-X-73680; E-9212) Avail: NTIS HC A02/MF A01 CSCL 11A

This investigation of the problems associated with reliably containing gaseous helium pressurized to 1530 bars (22 500 psi) between 4.2 K and 150 K led to the following conclusions: (1) common seal designs used in existing elevated-temperature pressure vessels are unsuitable for high-pressure cryogenic operation, (2) extrusion seal-ring materials such as Teflon, tin, and lead are not good seal materials for cryogenic high-pressure operation; and (3) several high-pressure cryogenic seal systems suitable for large-pressure vessel applications were developed; two seals required prepressurization, and one seal functioned repeatedly without any prepressurization. These designs used indium seal rings, brass or 304 stainless-steel anvil rings, and two O-rings of silicone rubber or Kel-F. Author

N77-28494*# Carnegie-Mellon Univ., Pittsburgh, Pa.

SIMPLIFIED COMPUTER PROGRAM FOR THE ANALYSIS OF PHASE CHANGE IN LIQUID FACE SEALS Final Report

Michael Birchak and William F. Hughes May 1977 46 p refs (Grant NsG-3023)

(NASA-CR-134668) Avail: NTIS HC A03/MF A01 CSCL 11A

A simplified computer program is presented which allows for the prediction of boiling (phase change) in liquid face seals. The program determines if and when boiling occurs and then calculates the location of the boiling interface, pressure and temperature profiles, and load. The main assumption which allows for a simplified analysis is the assumption of an isothermal gas phase. Author

N77-28495# Thermo Electron Corp., Waltham, Mass.
FEASIBILITY TEST ON COMPOUNDING THE INTERNAL COMBUSTION ENGINE FOR AUTOMOTIVE VEHICLES, TASK 2 Final Report
1976 250 p refs
(Contract E(11-1)-2690)
(COO-2690-1) Avail: NTIS HC A11/MF A01

The most attractive use of the Organic Rankine Cycle System (ORCS) is in large, heavy-duty diesel trucks for long distance hauling. A conceptual design study of compounding the diesel truck engine with an ORCS was made. Based on the results of the conceptual design study which showed a 15 percent fuel economy improvement potential over the duty cycle, an early feasibility demonstration test of the system was initiated. The demonstration system used a Mack ENDT 676 diesel engine with existing but nonoptimum ORCS hardware made available from an earlier automotive Rankine cycle program. The results of these feasibility demonstration tests, both steady state and transient, over the operating range of the diesel engine, are presented. ERA

N77-28496# United Technologies Research Center, East Hartford, Conn.
EVALUATION OF BASIC LASER WELDING CAPABILITIES Technical Report, Nov. 1975 - Feb. 1977
Edward M. Breinan, C. M. Banas, G. P. McCarthy, and B. A. Jacob Mar. 1977 62 p refs
(Contract N00014-74-C-0423)
(AD-A039059; UTRC/R77-911989-10) Avail: NTIS HC A04/MF A01 CSCL 13/8

HY-130 alloy steel was laser-welded in a series of thicknesses including 0.64, 0.95, and 1.27 cm at continuous laser powers ranging from 6.0 to 12.8 kW and speeds between 1.27 and 2.96 cm/sec. All welds were visually inspected, X-rayed, magnafluxed, and subjected to a series of mechanical tests including hardness, bend, tensile, impact, and dynamic tear tests. Although some of the specimens, primarily those of intermediate thickness (0.95 cm), encountered porosity problems during laser welding, all specimens performed extremely well in mechanical tests. Based on the sum total results, it was concluded that the laser welding process is capable of making acceptable and mechanically excellent welds in HY-130 alloy steel through 1.27 cm thickness. Weldability of the alloy was found to be improved by better deoxidation practice in the original steelmaking (i.e. rare-earth treatment), although substantial elimination of inclusions by the Fusion Zone Purification effect was observed and quantitatively verified in all cases of HY-130 laser welding encountered during the course of this study. Author (GRA)

N77-28497# Naval Postgraduate School, Monterey, Calif.
THE FINITE ELEMENT METHOD APPLIED TO FLOWS IN TURBOMACHINES M.S. Thesis
Valentin Francisco Gavito, Jr. Dec. 1976 125 p refs
(AD-A038759) Avail: NTIS HC A06/MF A01 CSCL 20/4

The finite element method is applied to the two-dimensional, inviscid, compressible radial equilibrium equation for axial compressors. Isoparametric elements are used along with three-point Gaussian integration for stiffness matrix evaluation. The radial equilibrium equation is put into quasi-harmonic form for stream function formulation and results are presented using an isentropic flow assumption. Axial velocity profiles at rotor and stator blade edges are compared with published performance data of the NASA Task-1 stage transonic compressor and with numerical finite element results of Hirsch and Warzee. GRA

N77-28498# Metcut Research Associates, Inc., Cincinnati, Ohio.
MACHINING TESTS AND ANALYSIS ON 1018 AND 4330 STEELS
Watervliet Arsenal Watervliet Arsenal Jan. 1977 32 p
(Contract DAAA22-75-M-0419)
(AD-A038441; Rept-512-22568-1; WVT-CR-77003) Avail: NTIS HC A03/MF A01 CSCL 13/9

An examination of the report: an investigation to determine the single point cutting tool angles which yield maximum tool life by response surface methodology and evolutionary operation of processes, necessitated determining the optimum tool geometry which could be used to grind back and side rake tool angles for high speed steel tools. Machining tests and analysis were done on 1018 and 4330 steels. GRA

N77-28499# Ampex Corp., Redwood City, Calif. Research and Advanced Technology Div.
FOIL BEARING INVESTIGATION Final Report, 1 Jul. 1970 - 30 Sep. 1976
A. Eshel 31 Dec. 1976 10 p refs
(Contract N00014-71-C-001; NR Proj. 062-297)
(AD-A038109; RR-77-02) Avail: NTIS HC A02/MF A01 CSCL 13/9

Foil bearing research performed at Ampex under ONR sponsorship is summarized. Theoretical and experimental effort has been carried out in three areas: development of analytical and experimental techniques applicable to foil bearings, as well as to other fields; application of foil bearings for support of high speed rotating machinery and application of foil bearings in magnetic recording. Author (GRA)

N77-28500# AiResearch Mfg. Co., Phoenix, Ariz.
INTEGRAL, LOW-COST, HIGH-TEMPERATURE TURBINE FEASIBILITY DEMONSTRATOR (SMALL LAMINATED AXIAL TURBINE PROGRAM) Final Report, Mar. 1974 - Sep. 1976
D. Furst, R. W. Vershure, J. A. Pyne, and J. J. Clark Wright-Patterson AFB, Ohio AFAPL Feb. 1977 195 p
(Contract F33615-74-C-2034; AF Proj. 3066)
(AD-A038674; AiResearch-74-210841(29); AFAPL-TR-77-2) Avail: NTIS HC A09/MF A01 CSCL 21/5

The Integral Low-Cost, High-Temperature Turbine Feasibility Demonstrator Program was conducted to establish the feasibility of constructing a small, integral, cooled turbine using photoetched laminates bonded together to form a complete wheel. A turbine design was established utilizing a cooling scheme compatible with operation at 2600 F. Methods were established for making the laminate photoetch tooling with the use of computer graphic design techniques. Photoetching and bonding parameters were optimized through the use of small bonded stacks. The photoetch and bonding methods were further optimized by bonding full-size wheel blanks, and the successful construction of a complete integral, cooled, laminated turbine. The wheel integrity was established by subjecting it to a 115-percent design speed spinpit test. It is recommended that this method of turbine construction be further developed because of the great potential for both cost-reduction and achieving high operating temperature capability through this approach. Author (GRA)

N77-28501# General Motors Corp., Indianapolis, Ind. Detroit Diesel Allison Div.
DEVELOPMENT AND EVALUATION OF PROCESSES FOR DEPOSITION OF Ni/Co-Cr-AlY (MCrAlY) COATINGS FOR GAS TURBINE COMPONENTS Final Report
J. O. Hodshire Jan. 1977 74 p refs
(Contract F33615-76-C-5047)
(AD-A038509; Rept-8945; AFML-TR-76-230) Avail: NTIS HC A04/MF A01 CSCL 21/5

The feasibility of producing an MCrAlY type overlay coating structure by electrophoretic (AEP) deposition was demonstrated. A NiCrAlY coating was produced on directionally solidified Mar M006 by AEP deposition of chemically activated NiCrY powder with subsequent cold isostatic pressing and aluminizing treatments. The NiCrAlY coating microstructure consisted essentially of chromium rich particles in a Ni-Cr-Al matrix and minimal interdiffusion with the base metal. The structure contained scattered porosity. Cold isostatic pressing was introduced near the end of the Task I effort. The AEP NiCrAlY process feasibility was demonstrated. GRA

N77-28502# Pennsylvania State Univ., University Park. Applied Research Lab.
EXPERIMENTAL AND ANALYTICAL STUDY OF A STREAM

VANE EXPANDER Ph.D. Thesis
Gerald F. Robertson 1 Feb. 1977 141 p refs
(Contract N00017-73-C-1418)
(AD-A038878; TM-77-65) Avail: NTIS HC A07/MF A01 CSCL 21/5

An experimental and analytical study of a rotary vane steam expander was conducted to determine the effect of leakage, friction and heat transfer on the expander performance. A commercially available rotary vane air motor was modified to operate on steam utilizing little or no liquid lubricant. The indicated power output, shaft power output and frictional power loss of the vane expander were experimentally determined as a function of speed, inlet timing, and supply steam conditions. The steam mass flow rate and component temperatures were also measured. The data show that severe internal leakage and frictional energy dissipation were major causes of efficiency reductions. An analytical model of the expander thermodynamics, friction, leakage and heat transfer was developed from fundamental principles. The model predicts the expander leakage flow rate, frictional power loss heat transfer rate, and the effect of these losses on the power output and efficiency. The analytically and experimentally determined frictional power losses were in agreement. The component temperature profiles were predicted with maximum errors of 10% - 15%. The predicted leakage flow was approximately 16% below the experimentally determined value. Errors in the leakage flow predictions resulted in the predicted indicated power outputs being 20% - 40% below the experimental values. This was considered reasonably good in light of the difficulty in identifying the steam leakage paths and component clearances. Author (GRA)

N77-28503# National Bureau of Standards, Washington, D. C. Engineering Mechanics Section.
SKID RESISTANCE MEASUREMENT TESTS OF NEW FHWA REFERENCE SYSTEMS AT THE EASTERN FIELD TEST CENTER Final Report, Feb. - Apr. 1976
R. W. Kearns and J. F. Ward Mar. 1977 131 p refs Sponsored in part by Federal Highway Admin.
(PB-265102/4; NBSIR-77-1213) Avail: NTIS HC A07/MF A01 CSCL 13B

The Federal Highway Administration (FHWA) is developing a program to improve the method of measuring wet weather pavement skid resistance (SN) and to reduce the variation in results. At the national level, an interim reference system (IRS) is maintained and operated by the National Bureau of Standards. At the regional level, an area reference system (ARS) is maintained and operated at each FHWA Field Test Center. Intercomparisons between these reference systems and the highway measuring systems at the state level provide measurement assurance. In this report, the first correlations between three identical, newly manufactured systems (ARS 1, 2, 3) and the IRS are given. Computer standard deviations of mid-range predicted SN values are typically less than 0.1 SN. SN is given as a function of test speed for each system, on two test surfaces. Speed gradients of SN are found to be characteristic of the surface. GRA

N77-28504# Pennsylvania Transportation Inst., University Park.
MEASUREMENT OF HYDROPLANING POTENTIAL Final Report
S. K. Agrawal, W. E. Meyer, and J. J. Henry Feb. 1977 100 p refs Sponsored by Pennsylvania Dept. of Transportation, and in part by DOT
(PB-265061/2; PTI-7701; FHWA/PA-72/6) Avail: NTIS HC A05/MF A01 CSCL 13F

Hydroplaning is a condition in which the vehicle tires are separated from the pavement by a layer of water. Thus, steering and braking capabilities are greatly reduced. Various methods are employed to control hydroplaning; pavement grooving and providing coarse texture finish are two examples. Their primary purpose is to provide an escape path for water under the tire. The measurement of hydroplaning potential of pavements, that is, of the inability of accumulated water to escape from the tire-pavement contact area, affords a useful criterion for ranking the performance of the pavements. The results show that very low values of Brake Force Coefficient are obtained when an ASTM Standard E 524 tire is tested at 24 psi (1.66 bar) inflation pressure and 650-lb (295-kg) vertical load. These results enabled the selection of the test parameters for testing at speeds which were easily attainable at the test facility. An important finding was that delivering the water approximately 6.5 ft (2m) ahead of the tire provided thick waterfilm thicknesses required for hydroplaning. By simple modification to the existing friction tester, the hydroplaning potential of four different pavements was measured in terms of the speed above which hydroplaning will occur. GRA

N77-28505# Naval Ship Research and Development Center, Annapolis, Md. Propulsion and Auxiliary Systems Dept.
MODERATORS' REPORTS FROM THE WORKSHOP ON MECHANICAL TRANSMISSIONS FOR HIGH PERFORMANCE
Alfred B. Harbage Mar. 1977 66 p Conf. held at David W. Taylor Naval Ship Research and Development Center, Annapolis, Md., 29-30 Sep. and 1 Oct. 1976
(AD-A036449; PAS-76-47) Avail: NTIS HC A04/MF A01 CSCL 13/9

On September 29, 30 and October 1, 1976 a High Performance Ship Transmission Workshop was conducted at DTNSRDC Annapolis, Md. The Workshop was attended by Defense Department and private sector personnel informed in various aspects of transmission design, development, manufacture and operational problem solving. This report is a summary of information gleaned from this three day effort. Author (GRA)

N77-28506# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
AIDING THE MACHINING OF COMPLEX SHAPES Final Report, Sep. 1972 - Sep. 1973
Stephen W. Cairns, Edward T. Furrow, and Daniel E. Whitney 12 Feb. 1974 185 p refs
(Grant NSF GI-34713)
(PB-265900/1; NSF/RA/T-74-057) Avail: NTIS CSCL 13H

The problem of directing a cutting tool over an arbitrary contoured surface in two dimensions (three axes) is studied. A new numerical algorithm for steering the tool, belonging to a family called tool rate methods, is developed and shown to be computationally as accurate and, for the examples tested, about twice to three times as fast as conventional techniques. Comparative results are shown, and all relevant computer program listings are provided. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N77-28507# Bendix Corp., Kennedy Space Center, Fla.
APPLICATION AREAS FOR STATISTICAL METHODS
R. L. Kirkpatrick Apr. 1976 22 p
(Contract E(29-1)-0613)
(BDX-613-1600) Avail: NTIS HC A02/MF A01

Factors which affect product quality can be divided into two major categories: technological and human. Effective control over these factors requires controls at all important stages of production. Facilities selected for machining and processing and for assembly and packaging are an important determinant of the cost and quality. If selected measuring equipment, processes, machines and materials are sufficiently accurate to provide an in-tolerance part, resonable costs and acceptable quality can be expected. ERA

N77-28508# Army Electronics Command, Fort Monmouth, N. J. Product Assurance Directorate.
COST OPTIMIZING SYSTEM TO EVALUATE RELIABILITY (COSTER) Technical Report, Jan. 1975 - Dec. 1976
John P. Solomond and Grace A. Marseglia Apr. 1977 51 p refs
(AD-A038761; ECOM-4487) Avail: NTIS HC A04/MF A01 CSCL 14/1

Specific attention is currently being addressed to the overall cost of the reliability specification as early as the development stage in an equipment's life cycle. In order to assess the impact

of changes in an equipment's reliability specification, it must be possible to predict and monitor the effects of such changes on an equipment's reliability testing and field support costs. This research report elaborates the respective cost and reliability improvements resulting from six major reliability program efforts prior to an equipment's field deployment. The six efforts are: (1) the design review; (2) the reliability prediction program; (3) the failure mode, effects, and criticality analysis (FMECA); (4) the parts program, in which MIL-STD and high reliability parts are selectively used in place of commercially available parts; (5) the reliability testing programs; and (6) the Burnin test. One hundred sixty exhaustive 'policies' are analyzed with respect to their cost and resultant reliability. Each policy is a specific combination of the reliability program tasks imposed. The total policy cost is the sum of the reliability program cost and the expected field support cost after the equipment is deployed. The Field Support costs are assumed inversely related to the reliability level, as measured by the Mean Time Between Failure (MTBF), achieved prior to deployment. The model is computerized and sorts the total policy cost in ascending order. The optimal policy and the resultant MTBF corresponding to the minimum total cost are the outputs of the model. Author (GRA)

N77-28509# Naval Surface Weapons Center, Dahlgren, Va. Dept. of Armament Development.
POSITRON LIFETIME TECHNIQUE FOR NONDESTRUCTIVE EVALUATION OF MATERIALS Final Report
W. H. Holt and W. Mock, Jr. Dec. 1976 34 p refs
(AD-A038305; NCWC/DL-TR-3573) Avail: NTIS HC A03/MF A01 CSCL 11/6

The positron lifetime technique for monitoring changes in material properties is described. Examples of positron lifetime measurements in metals and nonmetals are given. Experiments performed on fatigued and thermally degraded materials indicate that the positron lifetime spectrum is sensitive to these material changes. Author (GRA)

N77-28510# Rome Air Development Center, Griffiss AFB, N.Y.
IMPLEMENTATION OF OPERATIONAL PROCEDURES FOR OPTIMIZED RELIABILITY AND COMPONENT LIFE ESTIMATOR (ORACLE) Technical Report, Jul. 1975 - Dec. 1976
George W. Lyne Mar. 1977 129 p
(AF Proj. 2338)
(AD-A039344; RADC-TR-77-49) Avail: NTIS HC A07/MF A01 CSCL 09/2

This report presents instructions for the implementation of the ORACLE Computer Program, as developed by the US Army, on the RADC/Honeywell GCOS 6000 Computer System. This version of the ORACLE Program is a software package which determines: (1) the failure rate of electronic piece-parts based on the procedures set forth in MIL-HDBK-217B, (2) the total piece-part failure rate of an electronic module, equipment and/or system, and (3) the MTBF for an electronic module, equipment and/or system based on the piece-part failure rates.
Author (GRA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N77-28511* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD FOR MEASURING BIAXIAL STRESS IN A BODY SUBJECTED TO STRESS INDUCING LOADS Patent
Wayman N. Clotfelter, inventor (to NASA) Issued 5 Dec. 1977 7 p Filed 28 Jun. 1976 Supersedes N76-26583 (14 - 17, p 2205)
(NASA-Case-MFS-23299-1; US-Patent-4,033,182; US-Patent-Appl-SN-700673; US-Patent-Class-73-88R; US-Patent-Class-73-67.7) Avail: US Patent Office CSCL 20K

A method is described for measuring stress in test articles including the steps of obtaining for a calibrating specimen a series of transit time differentials between the second wave echo for a longitudinal wave and the first wave echo for each of a pair of shear waves propagated through the specimen as it is subjected to known stress load of a series of stress loads for thus establishing a series of indications of the magnitudes for stress loads induced in the specimen, and thereafter obtaining a transit time differential between the second wave echo for a longitudinal wave and the first wave echo for each of a pair of shear waves propagated in the planes of the stress axes of a test article and comparing the transit time differential thus obtained to the series of transit time differentials obtained for the specimen to determine the magnitude of biaxial stress in the test article.
Official Gazette of the U.S. Patent Office

N77-28512 Detroit Univ., Mich.
FINITE ELEMENT PREDICTION OF RESIDUAL STRESS IN FORMED SHEET METAL Ph.D. Thesis
Herman Migliore 1976 130 p
Avail: Univ. Microfilms Order No. 77-2719

The procedure employs displacement loading to simulate loading of sheet metal by a punch head. Displacements were applied to nodes representing the punch contact region until maximum punch movement was simulated. Subsequently, displacements were applied in a reverse order, to simulate punch removal and elastic recovery of the forming operation. Clamping conditions, distinguishing draw forming from stretch forming, were simulated by constraining elements which represent the boundary region. Stretch forming involves totally constrained edges and is exemplified by forming an Olsen laboratory cup. Draw forming involves partially constrained edges and is exemplified by forming a Swift laboratory cup. Automobile panels, in general, are formed under a combination of these operations. Forming of a specific quarter panel (rear fender) was analyzed after performing both Olsen and Swift cup analyses. Dissert. Abstr.

N77-28513 State Univ. of New York, Buffalo.
AN EULERIAN APPROACH TO ELASTIC-PLASTIC DEFORMATION AT FINITE STRAINS Ph.D. Thesis
Peter Alan Dashner 1976 74 p
Avail: Univ. Microfilms Order No. 77-3528

In this research, which essentially deals with the problem initially posed by Lee, the mechanical description is developed from an Eulerian point of view. General states of elastic-plastic deformation are completely characterized by suitably defined Eulerian elastic and plastic finite strain tensors. Once the pre-yield response for a given material is specified, the classical results of finite elasticity are then used to rigorously determine the rate of dissipation of stress work in plastic flow. With this result, a consistent generalization of plastic potential theory is proposed which leads to the desired frame indifferent rate equation subject to certain requirements of invertibility. A specialization of these results for infinitesimal elastic strains is then shown to confirm the frame indifferent constitutive form proposed recently by McMeeking and Rice. The development of this theory relies heavily on the use of convected coordinate systems and the associated ideas of convected, rigid body and material time derivatives. A brief yet reasonably comprehensive review of these concepts is presented in the preliminary sections of this dissertation.
Dissert. Abstr.

N77-28514 Texas A&M Univ., College Station.
THE APPLICATION OF COMBINED KINEMATIC-ISOTROPIC HARDENING AND THE MECHANICAL SUBLAYER MODEL TO SMALL STRAIN INELASTIC STRUCTURAL ANALYSIS BY THE FINITE ELEMENT METHOD Ph.D. Thesis
Barry Hunsaker, Jr. 1976 94 p
Avail: Univ. Microfilms Order No. 77-2635

The continuum equations of motion are referred to the initial structural configuration and then linearized with respect to the displacement increments to obtain a form of the so-called total Lagrangian formulation whose kinematics are valid for large strains. These equations are then converted to a set of nonlinear differential equations via the finite element method. The formulation and computational procedures of two incremental plasticity theory hardening rules, namely combined kinematic-isotropic hardening and the mechanical sublayer model, are then presented with the limitation of small strains. Of particular interest is a new

method of determining sublayer parameters of the mechanical sublayer model applicable to multiaxial loading. Finally, three simple structures subjected to loading into the plastic range are analyzed using the finite element code AGGIE I. Dissert. Abstr.

N77-28515 Oklahoma Univ., Norman.
BUCKLING OF CYLINDRICAL SHELLS HAVING RECTANGULAR IMPERFECTIONS Ph.D. Thesis
R. S. Prabhu 1976 139 p
Avail: Univ. Microfilms Order No. 77-1843

The Koiter's concept of initial-postbuckling behavior applied to thin shell structures which exhibit rectangular imperfections is investigated. Decay length in the circumferential direction is varied to obtain the minimum potential energy since the shell buckling has a weak dependence on the shell curvature. Linear prebuckling is assumed for the displacements in the axial direction and for mid-surface displacements, but from the definition of prebuckling the effect of nonlinearity with respect to the axial load is considered. A computer program to calculate the ratio of bifurcation point load of the imperfect shell to the classical axial load of the perfect shell is developed. Dissert. Abstr.

N77-28516 Polish Academy of Sciences, Warsaw.
A STATISTICAL ANALYSIS OF AN ELASTIC PLATE WITH A RECTANGULAR OPENING USING THE FINITE ELEMENTS METHOD [ANALIZA STATYCZNA TARCZY SPREZYSTEJ Z OTWOREM PROSTOKATNYM METODA ELEMENTOW SKONCZONYCH]
J. Ostrowska-Maciejewska Dec. 1976 60 p refs In POLISH
Avail: Issuing Activity

The design of construction panels with elastic characteristics is analyzed. A plate with a discrete system of 24 degrees of freedom is examined. On the assumption that the basic finite element is a linear triangular element, the rigidity matrix of the plate is determined. This matrix after applying the condition of negation of forces at the edges of the opening, can be reduced to a matrix with the dimension of 16 x 16, i.e., a matrix of the same dimensions as those of the rigidity matrix of a complete plate. Details of the statistical analysis are presented. Author

N77-28517*# Grumman Aerospace Corp., Bethpage, N.Y.
STRESSES IN ACOUSTICALLY EXCITED PANELS AND SHUTTLE INSULATION TILES Final Report, Aug. 1975 - Nov. 1976
I. U. Otalvo Nov. 1976 73 p refs
(Contract NAS1-10635)
(NASA-CR-145222) Avail: NTIS CSCL 13M

Natural vibration and acoustic response results are presented for a 36 x 18 inch panel with 18 6 x 6-inch tiles of 1.0, 1.6 and 2.3 inch thicknesses. Computed results for an untiled panel are compared with experiments performed earlier. Natural frequency and acoustic response comparisons are also given for independent analyses performed upon tiled and untiled panels. The results indicate the general applicability of the computer programs developed for use as shuttle design and analysis tools. Author

N77-28518# Linkoeping Univ. (Sweden). Dept. of Mechanical Engineering.
COMPUTER SIMULATION OF FATIGUE CRACK PROPAGATION IN AIRCRAFT COMPONENTS
Jan Baecklund, Soeren Sjoestroem, and Hans Wennerstroem Feb. 1977 49 p refs Sponsored by SAAB-SCANIA AB
(ISBN-91-7372-147-6; ICAF-Doc-934) Avail: NTIS HC A03/MF A01

Cracks emanating from fastener holes propagated faster than expected in a part of the wing beam close to the fuselage. Laboratory tests were performed on specimens with simplified geometry designed so as to imitate the conditions in the critical part of the wing beam. Attempts to simulate the fatigue crack propagation in these specimens in a computer are presented. Author

N77-28519# Lockheed Missiles and Space Co., Palo Alto, Calif.
OPTIMIZATION BY WEIGHT OF AN ORTHOTROPIC CYLINDRICAL SHELL WITH VARIABLE PROPERTIES UNDER A VIBRATIONS FRQUENCY CONSTRAINT
I. S. Adamovich and R. B. Rikards [1977] 8 p refs Transl. into Izv. AN SSSR, Mekhan. Tverd. Tela (Moscow), no. 2, 1977 p 120-125
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Ill. 60616

The optimal design of complex structures using the finite element method is applied to an othotropic cylindrical shell with variable material stiffness. F.O.S.

N77-28520# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE INFLUENCE OF REINFORCEMENT PARAMETERS ON THE DYNAMIC STABILITY OF A CYLINDRICAL SHELL
O. I. Terebushko [1977] 7 p refs Transl. into ENGLISH from Prikl. Mekhan. (Kiev), v. 13, no. 3, 1977 p 10-16
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Ill. 60616

The behavior of a cylindrical shell reinforced by longitudinal and annular ribs, and subjected to the effect of a radial external pressure pulse distributed uniformly over the shell surface was studied in a geometrically nonlinear formulation. The reinforcement was considered regular and the shell as structurally orthotropic. It is shown that (1) the dynamic coefficient for reinforced shells is substantially lower than for unreinforced shells; (2) the ratio between the quantity of waves under dynamic buckling and the quantity of waves being formed under static buckling is considerably greater for an unreinforced than for a reinforced shell; and (3) the magnitude of the pulse causing the buckling is practically independent of the time of pulse effect for the range of the pressure-pulse effect. F.O.S.

N77-28521*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THREE-DIMENSIONAL ELASTIC STRESS AND DISPLACEMENT ANALYSIS OF FINITE GEOMETRY SOLIDS CONTAINING CRACKS
Jonathan Kring, John Gyekenyesi, and Alexander Mendelson 1977 16 p refs Presented at 23d Conf. of Army Mathematicians, Hampton, Va., 11-13 May 1977; sponsored by the Dept. of the Army Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland, Ohio
(NASA-TM-73717; E-9263) Avail: NTIS HC A02/MF A01 CSCL 20K

The line method of analysis is applied to the Navier-Cauchy equations of elastic equilibrium to calculate the displacement fields in finite geometry bars containing central, surface, and double-edge cracks under extensionally applied uniform loading. The application of this method to these equations leads to coupled sets of simultaneous ordinary differential equations whose solutions are obtained along sets of lines in a discretized region. Normal stresses and the stress intensity factor variation along the crack periphery are calculated using the obtained displacement field. The reported results demonstrate the usefulness of this method in calculating stress intensity factors for commonly encountered crack geometries in finite solids. Author

N77-28522*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DISPLACEMENT COEFFICIENTS ALONG THE INNER BOUNDARIES OF RADIALLY CRACKED RING SEGMENTS SUBJECT TO FORCES AND COUPLES
Bernard Gross Jul. 1977 17 p refs
(NASA-TM-73730; E-9218) Avail: NTIS HC A02/MF A01 CSCL 20K

Displacement results of plane boundary collocation analysis are given for various locations on the inner boundaries of radially cracked ring segments (C-shaped specimens) subject to two complementary types of loading. Results are presented for ratios of outer to inner radius R sub o/R sub i in the range of 1.1 to 2.5, and ratios a/W in the range 0.1 to 0.8 where a is the crack length for a specimen of wall thickness W. By combination of these results the resultant displacement coefficient delta or the corresponding influence coefficient, can be obtained for any practical load line location of a pin loaded specimen. Author

N77-28523# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
A STUDY OF STRUCTURAL FAILURE MODES FOR A COMPUTER CRASH SIMULATION

R. Winter Mar. 1977 63 p refs
(RM-630) Avail: NTIS HC A04/MF A01

The failure modes of a stiffened skin structure, built-up from beams, stringers, frames, and panels, under a single continuously increasing deformation event are investigated. Author

N77-28524*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MINIMUM-MASS DESIGN OF FILAMENTARY COMPOSITE PANELS UNDER COMBINED LOADS: DESIGN PROCEDURE BASED ON A RIGOROUS BUCKLING ANALYSIS
W. Jefferson Stroud, Nancy Agranoff, and Melvin S. Anderson Washington Jul. 1977 41 p refs
(NASA-TN-D-8417; L-11143) Avail: NTIS HC A03/MF A01 CSCL 13M

A procedure is presented for designing uniaxially stiffened panels made of composite material and subjected to combined inplane loads. The procedure uses a rigorous buckling analysis and nonlinear mathematical programing techniques. Design studies carried out with the procedure consider hat-stiffened and corrugated panels made of graphite-epoxy material. Combined longitudinal compression and shear and combined longitudinal and transverse compression are the loadings used in the studies. The capability to tailor the buckling response of a panel is also explored. Finally, the adequacy of another, simpler, analysis-design procedure is examined. Author

N77-28525*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AEROELASTIC ANALYSIS FOR ROTORCRAFT IN FLIGHT OR IN A WIND TUNNEL
Wayne Johnson Washington Jul. 1977 253 p refs Prepared in cooperation with Army Air Mobility Res. and Develop. Lab., Moffett Field, Calif.
(NASA-TN-D-8515; A-6740) Avail: NTIS HC A12/MF A01 CSCL 01C

An analytical model is developed for the aeroelastic behavior of a rotorcraft in flight or in a wind tunnel. A unified development is presented for a wide class of rotors, helicopters, and operating conditions. The equations of motion for the rotor are derived using an integral Newtonian method, which gives considerable physical insight into the blade inertial and aerodynamic forces. The rotor model includes coupled flap-lag bending and blade torsion degrees of freedom, and is applicable to articulated, hingeless, gimballed, and teetering rotors with an arbitrary number of blades. The aerodynamic model is valid for both high and low inflow, and for axial and nonaxial flight. The rotor rotational speed dynamics, including engine inertia and damping, and the perturbation inflow dynamics are included. For a rotor on a wind-tunnel support, a normal mode representation of the test module, strut, and balance system is used. The aeroelastic analysis for the rotorcraft in flight is applicable to a general two-rotor aircraft, including single main-rotor and tandem helicopter configurations, and side-by-side or tilting proprotor aircraft configurations. Author

N77-28526# Rochester Univ., N. Y. Dept. of Mechanical and Aerospace Sciences.
CRACK PROPAGATION WITH CRACK TIP CRITICAL BENDING MOMENTS IN DCB SPECIMENS
S. J. Burns and C. L. Chow 1976 24 p refs Presented at Fast Fracture and Crack Arrest Conf., Chicago, Jun. 1976
(Contract EY-76-S-02-2422)
(COO-2422-05; Conf-7606110-1) Avail: NTIS HC A02/MF A01

Experimental measurements of the time dependence of the shear force were used to calculate the specific fracture surface energy versus crack velocity. The crack velocity in a single speciment decreases with increasing time, it varies by a factor of 5 and is typically 0.01 of E/rho. Details of the experimental measurements for brittle and ductile fractures, including stress intensity values versus crack velocity are described. ERA

N77-28527# Dayton Univ., Ohio.
STABILITY OF FLAT, SIMPLY SUPPORTED RECTANGULAR SANDWICH PANELS SUBJECTED TO COMBINED INPLANE LOADINGS. VOLUME 2: COMPUTER PROGRAM USERS MANUAL
Robert A. Brockman Jan. 1977 78 p
(Contract F33615-75-C-3009)
(AD-A038341; UDRI-TR-76-02) Avail: NTIS CSCL 13/13

A computer program which implements the stability analysis of flat, simply supported sandwich composite panels is presented. The program is operable either in an interactive or batch mode, and provides for multiple problem runs and selective editing of current problem data. Instructions for data input are given, and a number of example problems are shown. The numerical analysis which is applicable to three-layer sandwich constructions having isotropic thin face sheets and orthotropic cores, is based upon a Ritz-method discretization of the linearized potential energy. Author (GRA)

N77-28528# Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering and Management Sciences.
A MODEL FOR OPTIMAL MASS SCREENING AND THE CASE OF PERFECT TEST RELIABILITY
William P. Pierskalla and John A. Voelker (Montgomery Ward Co., Chicago) 31 Dec. 1976 41 p refs
(Contracts N00014-67-A-0356-0030; N00014-75-C-0797; NR Proj. 042-322)
(AD-A038257; TR-3) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper considers a population (composed, for example, of people, machines, or livestock) subject to a randomly occurring defect or disease. If there exist testing procedures capable of detecting the defect before it would otherwise become known, and if such early detection provides benefit, the periodic administration of such as test procedure to the members of the population, i.e., a mass screening program, may be advisable. An analytical model of a mass screening program is developed and analyzed. In the development of the model, the defect arrival process is Poisson and the ability of the test to recognize a defect is not, in general, assumed perfect. The model focuses on the time since incidence of a defect as the factor which determines the reliability of a test administration and the value of a detection. The objective is to minimize an arbitrary increasing function of the detection delay which represents the disutility from the occurrence of the defect and its detection. This disutility is also represented as a function of the type of test applied, the probability of success of the test, the testing intervals and the arrival rates of the defects over Q subpopulations. A relatively simple expression is derived for the objective function and a comprehensive mathematical program is presented. The case of perfect test reliability is then considered and, from the class of 'cyclic' schedules, the optimum schedules are shown to be equally spaced. For a polynomial disutility function, properties of the optimal schedules are presented. Finally, a method for determining the disutility function from experimental data is suggested. Author (GRA)

N77-28529# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
AN INTERPOLATIVE MODEL FOR ELEVATED TEMPERATURE FATIGUE CRACK PROPAGATION Final Report, 3 Feb. 1975 - 31 Jul. 1976
C. G. Annis, Jr., R. M. Wallace, and D. L. Ims Nov. 1976 39 p refs
(Contract F33615-75-C-5097)
(AD-A038070; FR-8042; AFML-TR-76-176) Avail: NTIS HC A03/MF A01 CSCL 20/11

A flexible alternative to the familiar Paris equation has been developed for the interpolative analysis of elevated temperature fatigue crack propagation data. The model is based on the hyperbolic sine equation, log(da/dn) = C sub 1 sine h (C sub 2(log (delta K) + C sub 3)) + C sub 4, and the coefficients are shown to be simple functions of test frequency, stress ratio, and temperature. This methodology has been successfully used to describe crack propagation characteristics of selected nickel-base, titanium, and steel alloys. Author (GRA)

N77-28530# Oakland Univ., Rochester, Mich. School of Engineering.
THE DIFFICULT CHOICE
A. J. Durelli May 1977 54 p refs
(Contract N00014-76-C-0487)
(AD-A038845; Rept-44) Avail: NTIS HC A04/MF A01 CSCL 20/11

It is necessary to weigh the advantages and limitations of the numerous methods available today for the analyses of displacements, strain, and stresses. Systematic studies are lacking on this subject. In this paper after comments are made on several theoretical approaches, in particular approximates methods, attention is concentrated on experimental methods and considerations are made on the relative merits of: (1) photoelasticity, moire, brittle and photoelastic coatings, gages, grids, holography and speckle to solve two-dimensional problems; (2) photoplasticity and moire to solve problems in plasticity; (3) photo-ortho-elasticity, photoelastic coatings and moire to solve anisotropic problems; (4) the methods used to solve problems in dynamic photoelasticity; (5) the methods used in three-dimensional photoelasticity, and (6) projected gratings, shadow-moire and holography to analyze bent plates. General considerations are also made on the relative merit of whole-field methods, in comparison with point-by-point methods. Finally, an attempt is made at evaluating merit of the finite-element method in respect to the experimental stress analysis methods. GRA

N77-28531# Northwestern Technological Inst., Evanston, Ill. Structural Mechanics Lab.

A RAY THEORY FOR ELASTODYNAMIC STRESS INTENSITY FACTORS Interim Report

J. D. Achenbach and A. K. Gautesen Mar. 1977 31 p refs
(Contract N00014-76-C-0063)
(AD-A038113; NU-SML-TR-77-1) Avail: NTIS HC A03/MF A01 CSCL 20/11

Elastodynamic stress intensity factors generated by the interaction of wave motions with a crack are analyzed. It is shown that in an asymptotic approximation for high frequencies, the stress intensity factors at the edge of a crack are related to the fields of incident rays by a matrix of stress intensity factor coefficients, which can be computed from canonical solutions. The canonical solutions are the fields describing diffraction by a semi-infinite crack of plane body waves and plane surface waves, which are incident under an arbitrary angle with the edge of the crack. Several applications of the theory are presented. Author (GRA)

N77-28532# New Jersey Inst. of Technology, Newark.

OPTIMAL FREQUENCY SEPARATION IN CYLINDRICAL SHELLS Interim Report

Michael Pappas Mar. 1977 29 p refs
(Contract N00014-75-C-0987)
(AD-A039093; NJIT-NV-11) Avail: NTIS HC A03/MF A01 CSCL 20/11

A new and powerful algorithm is applied to the problem of optimal frequency separation of stiffened cylindrical shells. New methodology is introduced which allows the simultaneous separation of several modes of vibration. Results indicate that the procedure can effectively deal with this difficult optimization problem. Author (GRA)

N77-28533# Dayton Univ., Ohio. Research Inst.

BUCKLING OF CYLINDRICAL SANDWICH PANELS WITH LAMINATED FACES Final Report, Nov. 1974 - Oct. 1975

R. A. Brockman Wright-Patterson AFB, Ohio AFFDL Jan. 1977 65 p refs
(Contract F33615-75-C-3009)
(AD-A038295; UDRI-TR-C-74; AFFDL-TR-76-151) Avail: NTIS HC A04/MF A01 CSCL 13/13

General stability of a cylindrically curved sandwich panel with laminated composite face sheets is considered. The analysis accounts for axial compression, edgewise shear, or combined loadings. A mathematical model is formulated, based upon a linear potential energy expression and the Ritz method of discretization. Comparisons are made of the present method with a number of analytical and experimental buckling results. Limitations of the linear stability analysis are discussed in detail. Author (GRA)

N77-28534# Polytechnic Inst. of New York, Brooklyn.

STATIC AND DYNAMIC BEHAVIOR OF NONCIRCULAR CYLINDRICAL SHELLS Final Report, 1 Jan. 1974 - 31 Dec. 1976

Joseph Kempner Feb. 1977 25 p refs
(Contract F44620-74-C-0047; AF Proj. 9782)
(AD-A038203; POLY-M/AE-77-5; AFOSR-77-0212TR) Avail: NTIS HC A02/MF A01 CSCL 13/3

During the past contract, emphasis has been placed upon problems concerned with the buckling, postbuckling, and vibrations of rings and cylindrical shells of variable curvature. Some work was also performed on reinforced spherical and noncircular cylindrical shells. The list of references at the end of this report represents reports, publications, talks, and theses prepared during the course of the contract period. Author (GRA)

N77-28535# Virginia Polytechnic Inst. and State Univ., Blacksburg.

RELIABILITY STUDY OF SINGER. VOLUME 2: USERS MANUAL Final Report

A. E. Somers, S. M. Holzer, J. C. Bradshaw, and R. G. Galloway Jan. 1977 371 p refs
(Contract F29601-75-C-0050)
(AD-A038317; AFWL-TR-76-192-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 13/13

The second volume of this report is principally developed for the user, as an aid in the use and modification of the SINGER code. The objective is to document the experience gained through the study of problem solutions and code details. In addition, this volume includes the description of new subroutines developed and a listing of the current version of the code. Author (GRA)

N77-28536# Naval Surface Weapons Center, Dahlgren, Va. Dept. of Armament Development.

DYNAMIC FRACTURE AND FRAGMENTATION OF CYLINDERS Final Report

C. Robert Crowe, William H. Holt, Willis Mock, Jr., and O. Hayden Griffin Nov. 1976 64 p refs
(SF32353302)
(AD-A038306; NSWC/DL-TR-3449) Avail: NTIS HC A04/MF A01 CSCL 19/1

An experimental and theoretical investigation of the mechanisms of fragmentation has been conducted for explosive-filled cylinders of Armco iron and HF-1 steel. Dynamic fracture nucleation and growth parameters for HF-1 steel were determined from gas gun experiments for use in computer modeling of the fracture and fragmentation processes. Calculated fragment mass distributions are compared with experimental results. Author (GRA)

N77-28537# New York State Dept. of Transportation, Albany. Engineering Research and Development Bureau.

THICK-LIFT FLEXIBLE PAVEMENT WEARING COURSES Interim Report

Robert J. Nittinger Feb. 1977 22 p refs Sponsored by Federal Highway Admin.
(PB-264895/4; NYSDOT-ERD-77-RR-41) Avail: NTIS HC A02/MF A01 CSCL 13B

Two-lift construction (placing binder and top courses over either a base course or existing pavement) has long been accepted practice. New York State 1973 specifications required that all paving in upstate counties be completed before October 15, and that the binder course not be exposed over the winter. This places the contractor in a precarious situation. Pavement construction scheduling may require placing the top course after this deadline. By the time the base is placed, the construction season is generally into late September or early October, after which the binder is placed (provided no adverse weather conditions occur), thus carrying construction into late September or early October. The contractor has perhaps one to three weeks to place top course if the weather is acceptable; this is often impossible. Eliminating the binder would help alleviate this problem. Placing a thicker top course in one lift would help heat retention and possibly contribute to higher densities and lower void contents, and the paving deadline could be extended. Field experiments show this to be true. Pavement roughness was of special concern because the binder is also known as a 'shim' course; its elimination might create a rougher riding surface. The average driver, however, cannot discern any appreciable changes in roughness because these are so slight. The thick-lift wearing course provided a denser pavement and was much more efficient to place. GRA

N77-28538# New York State Dept. of Transportation, Albany. Engineering Research and Development Bureau.
VIBRATION OF PAVEMENT CONCRETE Interim Report
James E. Bryden and Robert W. Rider Mar. 1977 53 p refs
(PB-265358/2; RR-77-40; NYSDOT-ERD-77-RR-40) Avail: NTIS HC A04/MF A01 CSCL 13B

The effects of spud vibrations mounted on slipform pavers were examined on three paving projects. Slump and entrained air of the plastic concrete were measured and paver speed was deliberately varied. A total of 364 pavement cores were taken at various distances from the vibrators for determination of density, entrapped air content, aggregate distribution, and mesh embedment. Riding quality of the finished pavement was also measured. No aggregate segregation was found, and riding quality was not affected by the vibrators. The only appreciable effect on the reinforcing mesh was a slight increase in depth directly beneath the vibrators. GRA

N77-28539# Portland Cement Association, Skokie, Ill.
DESIGN AND CONSTRUCTION OF LARGE-PANEL CONCRETE STRUCTURES. REPORT NO. 2: PHILOSOPHY OF STRUCTURAL RESPONSE TO NORMAL AND ABNORMAL LOADS
Mark Fintel, Donald M. Schultz, and Mohammad Lqbal Aug. 1976 146 p refs
(Contract HUD-H-2131)
(PB-264756/8) Avail: NTIS HC A07/MF A01 CSCL 13M

Response of large panel structures to both normal loading and abnormal loadings is discussed qualitatively. Conditions particular to these structures which can affect their behavior are identified. Methods for reducing the risk of progressive collapse from abnormal loads are examined. A philosophy of design based on bridging local damage is introduced which emphasizes continuity and ductility within and across connections. A methodology is developed to be used in establishing minimum detailing criteria to ensure integrity of the structure. In this general structural integrity approach code requirements for minimum ties will be provided to assure an alternative path for the load in the event of a local failure of a primary load bearing element. Design considerations for both individual elements and connections are discussed conceptually. GRA

N77-28540# Southwest Research Inst., San Antonio, Tex.
MICROPLASTICITY, TENSILE FAILURE, AND INDENTATION DAMAGE IN UNFLAWED POLYCRYSTALLINE ALUMINA Interim Report, 1 Apr. 1976 - 28 Feb. 1977
James Lankford, Jr. 6 Apr. 1977 24 p refs
(Contract N00014-75-C-0068)
(AD-A038426; SwRI-02-4231-001) Avail: NTIS HC A02/MF A01 CSCL 11/2

Scanning electron microscopy and acoustic emission has been used to study microfracture events occurring prior to tensile failure of unflawed Al2 O3 tested at 23 and 410 C. A strengthening effect at the latter temperature is shown to be caused by multiple twinning, and enhanced twinning in general. Twinning is found to be responsible for crack initiation at room temperature. In other experiments, SEM was used to observe microfracture events in Al2 O3 caused by sharp indenters. It was found that lateral crack formation was nucleated by mechanical twins located along the inner walls of the indents. The possible relationship of this process to erosion is discussed. Author (GRA)

N77-28541# Northwestern Univ., Evanston, Ill. Dept. of Materials Science and Engineering.
COMPARISON OF MEASURING TIMES FOR X-RAY DETERMINATION OF RESIDUAL STRESSES: A NORMAL DETECTOR AND A POSITION SENSITIVE DETECTOR
M. R. James and J. B. Cohen 15 Mar. 1977 16 p refs
(Contract N00014-75-C-0580; NR Proj. 031-733)
(AD-A038103; TR-15) Avail: NTIS HC A02/MF A01 CSCL 11/6

The use of a position sensitive detector (PSD) in the measurement of residual stress by the X-ray technique has been described previously (see T.R. No. 11). To quantify the actual time savings for the stress determination, a complete comparison was carried out between a normal diffractometer measurement and a PSD measurement. The speed of the PSD is dependent on the profile characteristics and the desired accuracy of the measurement. Therefore, measurements were carried out on six steel samples covering the full range of peak breadths and for both a high and a low statistical counting accuracy. In all cases, the PSD was considerably faster than the normal detector, from 100 times quicker for the most favorable case (sharp profile, high statistical error) to twice as fast (broad profile, low statistical error) for the least favorable case. Author (GRA)

N77-28542# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.
NONLINEAR MONOTONIC FUNCTIONS WITH SELECTABLE INTERVALS OF ALMOST CONSTANT OR LINEAR BEHAVIOR WITH APPLICATION TO TOTAL STRAIN VISCOPLASTICITY
E. P. Cernocky and E. Krempl Jan. 1977 53 p refs
(Contract N00014-76-C-0231)
(AD-A036344; RPI-CS-77-1) Avail: NTIS HC A04/MF A01 CSCL 20/11

A rather general method is given to construct classes of functions with an arbitrary almost constant (linear) initial interval followed by a nonprescribed interval of monotonic nonlinear behavior. This region of nonlinear behavior is succeeded by an unbounded interval of almost constant (linear) behavior. They contain not more than four selectable parameters and are synthesized from analytic, monotonic, normalized and bounded base functions through the introduction of two separate kernel sets, subsequent addition and integration. As examples we give the special functions based on the error, the hyperbolic tangent, the inverse tangent, a rational and the incomplete gamma function. Limiting function forms, such as the bilinear form, are derived for limiting values of the parameters. We have found these functions useful in the total strain approach to viscoplasticity, i.e., the analytical modelling of stress-strain diagrams, strain (stress)-rate effects, creep and relaxation curves for monotonic and cyclic loading. Also these functions offer great flexibility in the curve fitting of experimental data generated in the above-mentioned tests. Author (GRA)

N77-28543# Michigan Dept. of State Highways and Transportation, Lansing. Research Lab. Section.
DEVELOPMENT OF PROCEDURES FOR REPLACING JOINTS IN CONCRETE PAVEMENT Final Report, 1971 - 1976
J. E. Simonsen Sep. 1976 29 p
(PB-265798/9; R-1020) Avail: NTIS HC A03/MF A01 CSCL 13B

A previously sawed concrete area, up to 10 ft long, and one lane wide, can be replaced with a precast slab and opened to traffic in about 1-1/2 hours. A similar size area can be repaired with fast-set concrete and opened to traffic in 6 to 8 hours. Evaluation of the performance of the repairs indicates that both repair types will perform reasonably well for at least 5 years and it is expected that the majority of the repairs will continue to give good service for 10 years. GRA

N77-28544# Ohio State Univ., Columbus. Dept. of Civil Engineering.
A STUDY FOR LABORATORY IMPLEMENTATION OF FATIGUE MIX DESIGN PROCEDURES Final Report
Kamran Majidzadeh and Moses Karakouzian Dec. 1976 85 p
Sponsored in part by Ohio Dept. of Transportation,
(PB-265711/2; EES-483; FHWA/RD/M-0353) Avail: NTIS HC A05/MF A01 CSCL 13C

The evaluation of mixture characteristics was carried out using Marshall stability criteria, fracture toughness, dynamic modulus, modulus of resilience, indirect tensile strength and fatigue life estimation. It is shown that at low and intermediate service temperatures, the fatigue response is a controlling criterion, and the fatique parameter A is found to be an adequate representation of mixture properties. It has been concluded that the fatique-associated mixture design could be optimized using the principles of fracture mechanics. GRA

N77-28545# National Bureau of Standards, Washington, D. C. Center for Building Technology.
WIND AND SEISMIC EFFECTS: PROCEEDINGS OF THE 7TH JOINT PANEL CONFERENCE OF THE US-JAPAN

COOPERATIVE PROGRAM IN NATURAL RESOURCES
H. S. Lew Apr. 1977 513 p Conf. held at Tokyo, Japan, 20-23 May 1975
(PB-266077/7; NBS-SP-470) Avail: NTIS HC A22/MF A01 CSCL 13M

The subject matter covered includes characteristics of strong wind; response of full-scale structures to wind action; geological distribution of seismic activity; maintenance of strong motion accelerographs and data processing; strong earthquake motions and ground failures; response of hydraulic and building structures to seismic forces; seismic considerations for vessels; recent revisions of design standards on wind and seismic effects; joint research program utilizing large scale testing facilities; and technological assistance to developing countries. GRA

N77-28546# Connecticut Dept. of Transportation, Wethersfield. Bureau of Planning and Research.
IMPLEMENTATION OF STATISTICAL SPECIFICATIONS FOR CONTROL OF BITUMINOUS CONCEPTS, REPORT 4 Interim Report, Feb. - Oct. 1976
Keith R. Lane Oct. 1976 34 p
(PB-265352/5; FHWA-CT-RD-376-4-76-11) Avail: NTIS HC A03/MF A01 CSCL 13C

Statistical specifications were employed on a trial basis on a contract calling for a bituminous concrete pavement on a premix (Class 4) base and a rolled gravel base in the Town of Oxford. In contrast to normal procedures, control strips and nuclear gages were used to assess compactive effort. GRA

N77-28547# California Univ., Berkeley. Earthquake Engineering Research Center.
INFILLED FRAMES IN EARTHQUAKE-RESISTANT CONSTRUCTION
R. E. Klingner and V. V. Bertero Dec. 1976 292 p refs
(Grants NSF AEN-73-07734-A02; NSF ENV-76-04263)
(PB-265892/0; EERC-76-32) Avail: NTIS HC A13/MF A01 CSCL 13M

The effects of engineered masonry infill panels on the seismic hysteretic behavior of reinforced concrete frames are investigated experimentally and analytically. The experimental phase consists of quasi-static cyclic load tests on a series of one-third-scale model subassemblages of the lower three stories of an eleven-story, three-bay frame with infills in the two outer bays. Emphasis is placed on simulating the proper force and displacement boundary conditions. The infilled frames are found to offer many advantages over comparable bare frames, particularly, with respect to their performance under strong ground motions. GRA

N77-28766*# College of William and Mary, Williamsburg, Va.
SYMBOLIC MANIPULATION TECHNIQUES FOR VIBRATION ANALYSIS OF LAMINATED ELLIPTIC PLATES
C. M. Andersen and Ahmed K. Noor (George Washington Univ., Washington, DC) *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 161-175 refs Sponsored by NASA Langley Res. Center (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 20K

42 GEOSCIENCES (GENERAL)

N77-28548*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SKYLAB EXPLORES THE EARTH
Washington 1977 531 p refs Original contains color illustrations
(NASA-SP-380) Avail: NTIS MF A01; SOD HC $17.50 CSCL 08F

The quality and the quantity of photographic and observational data that could be acquired by the crew of the many types of earth features when supported by multidisciplinary scientific training before lift-off, by real-time science mission planning, and by a comprehensive onboard set of procedures, maps, and photographs are evaluated. The visual observations experiment aimed the following: (1) determine the types of surface, air, and water phenomena the crew could visually identify from the Skylab orbit, (2) determine what visual observations, supplemented by photography, could be accomplished to support scientific investigations, (3) explore the use of several data parameters in the study of multidisciplinary areas; and (4) determine the type of crew training necessary to perform the visual observations desired by scientists. Author

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N77-28549 Columbia Univ., New York.
SPECTRORADIOMETRIC DETECTION AND MAPPING OF AREAS ENRICHED IN FERRIC IRON MINERALS USING AIRBORNE AND ORBITING INSTRUMENTS Ph.D. Thesis
William Collins 1976 129 p
Avail: Univ. Microfilms Order No. 77-8248

An airborne spectroradiometer system was developed to take simultaneous 500 channel measurements of ground targets in the spectral regions between 4,250 A and 10,000 A. Survey flights with the instrument over an exposed hydrothermal alteration zone prove the value of high resolution aircraft measurements to compliment LANDSAT surveys. The high resolution data are necessary for determining the spectral properties of target materials, for establishing that these spectral properties are unique and will remain unique in the low spectral resolution LANDSAT data, and for accurately determining the nature and magnitude of spectral differences among targets under the broadband configuration. Field measurements from the aircraft are spatially integrated over contiguous 18 meter square fields of view along flight lines planned to cover both background and altered rock assemblages. Dissert. Abstr.

N77-28550*# Environmental Research Inst. of Michigan, Ann Arbor.
WHEAT PRODUCTIVITY ESTIMATES USING LANDSAT DATA Progress Report, 16 Feb. - 15 May 1977
Richard F. Nalepka, John Colwell, Principal Investigators, and Daniel P. Rice 15 May 1977 9 p refs ERTS
(Contract NAS5-22389)
(E77-10181; NASA-CR-153915; ERIM-114800-35-L) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N77-28551*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF LANDSAT-2 DATA TO THE IMPLEMENTATION AND ENFORCEMENT OF THE PENNSYLVANIA SURFACE MINING CONSERVATION AND RECLAMATION ACT Final Report, Mar. 1975 - May 1977
Orville R. Russell, Principal Investigator, David A. Nichols, and Richard Anderson May 1977 77 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21998)
(E77-10184; NASA-CR-153916) Avail: NTIS HC A05/MF A01 CSCL 08I

The author has identified the following significant results. Evaluation of LANDSAT imagery indicates severe limitations in its utility for surface mine land studies. Image stripping resulting from unequal detector response on satellite degrades the image quality to the extent that images of scales larger than 1:125,000 are of limited value for manual interpretation. Computer processing of LANDSAT data to improve image quality is essential; the removal of scanline stripping and enhancement of mine land reflectance data combined with color composite printing permits useful photographic enlargements to approximately 1:60,000.

N77-28552*# Sheffield Univ. (England).
A METHODOLOGY FOR PRODUCING SMALL SCALE RURAL LAND USE MAPS IN SEMI-ARID DEVELOPING COUNTRIES USING ORBITAL IMAGERY Final Report

J. L. vanGenderen, Principal Investigator and B. F. Lock Dec. 1976 313 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(E77-10187; NASA-CR-151173) Avail: NTIS HC A14/MF A01 CSCL 08B

The author has identified the following significant results. Results have shown that it is feasible to design a methodology that can provide suitable guidelines for operational production of small scale rural land use maps of semiarid developing regions from LANDSAT MSS imagery, using inexpensive and unsophisticated visual techniques. The suggested methodology provides immediate practical benefits to map makers attempting to produce land use maps in countries with limited budgets and equipment. Many preprocessing and interpretation techniques were considered, but rejected on the grounds that they were inappropriate mainly due to the high cost of imagery and/or equipment, or due to their inadequacy for use in operational projects in the developing countries. Suggested imagery and interpretation techniques, consisting of color composites and monocular magnification proved to be the simplest, fastest, and most versatile methods.

N77-28553*# Northern Prairie Wildlife Research Center, Jamestown, N. Dak.
APPLICATION OF LANDSAT SYSTEM FOR IMPROVING METHODOLOGY FOR INVENTORY AND CLASSIFICATION OF WETLANDS Progress Report, 1 Apr. - 30 Jun. 1977
David S. Gilmer and J. Colwell, Principal Investigators 15 Jul. 1977 7 p refs ERTS
(NASA Order S-54049-A)
(E77-10188; NASA-CR-153917) Avail: NTIS HC A02/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N77-28554*# Kentucky Dept. of Natural Resources and Environmental Protection, Frankfort.
A FEASIBILITY ANALYSIS OF THE EMPLOYMENT OF SATELLITE IMAGERY TO MONITOR AND INSPECT SURFACE MINING OPERATIONS IN WESTERN KENTUCKY, VOLUME 1 Final Report
Birney R. Fish, Principal Investigator Jan. 1977 196 p refs Sponsored by NASA ERTS
(E77-10189; NASA-CR-153918) Avail: NTIS HC A09/MF A01 CSCL 08I

The author has identified the following significant results. Surface mining violation estimates were scaled by scores assigned by ten inspectors from western Kentucky to each violation. A sensitivity analysis was made by varying the violation costs; costs were varied by using three different average durations. These durations were: (1) best estimated duration; (2) longest possible duration as restricted by the one year permit renewal and bond release regulations, and (3) shortest possible duration when inspections were made. If a social cost cannot be reduced, then the value of the social cost is irrelevant. Indications from the increased inspection rate of 1975 were that the total amount of fines collected per year remains constant independent of the increased detection rate.

N77-28555*# Kentucky Dept. of Natural Resources and Environmental Protection, Frankfort.
A FEASIBILITY ANALYSIS OF THE EMPLOYMENT OF SATELLITE IMAGERY TO MONITOR AND INSPECT SURFACE MINING OPERATIONS IN WESTERN KENTUCKY. VOLUME 2: APPENDICES Final Report
Birney R. Fish, Principal Investigator Jan. 1977 115 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 51798 ERTS
(E77-10190; NASA-CR-153919) Avail: NTIS HC A06/MF A01 CSCL 08I

There are no author-identified significant results in this report.

N77-28556*# National Scientific Labs., Inc., Falls Church, Va.
FREQUENCY REQUIREMENTS FOR ACTIVE EARTH OBSERVATION SENSORS Final Report
May 1977 109 p refs Prepared for JPL
(Contract JPL-954669)
(NASA-CR-153939) Avail: NTIS HC A06/MF A01 CSCL 05B

The foundation and rationale for the selection of microwave frequencies for active remote sensing usage and for subsequent use in determination of sharing criteria and allocation strategies for the WARC-79 are presented. Author

N77-28557*# Kanner (Leo) Associates, Redwood City, Calif.
TAXONOMIC CLASSIFICATION OF SOILS USING DIGITAL INFORMATION FROM LANDSAT DATA. HUAYLLAMARCA AND EUCALIPTUS AREAS M.S. Thesis - Bolivia Univ.
Samuel Quiroga Quiroga Washington NASA Jul. 1977 96 p refs Transl. into ENGLISH of "Clasificacion Taxonomica de Suelos Utilizando Inform. Digital de Dataos LANDSAT-Area Huayllamarca y Eucaliptus", Cochabamba (Bolivia).
(Contract NASw-2790)
(NASA-TM-75029) Avail: NTIS HC A05/MF A01 CSCL 08M

The applicability of LANDSAT digital information to soil mapping is described. A compilation of all cartographic information and bibliography of the study area is made. LANDSAT MSS images on a scale of 1:250,000 are interpreted and a physiographic map with legend is prepared. The study area is inspected and a selection of the sample areas is made. A digital map of the different soil units is produced and the computer mapping units are checked against the soil units encountered in the field. The soil boundaries obtained by automatic mapping were not substantially changed by field work. The accuracy of the automatic mapping is rather high. Author

N77-28558*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BOREHOLE HYDRAULIC COAL MINING SYSTEM ANALYSIS
Elmer L. Floyd 21 Apr. 1977 122 p refs
(Contract NAS7-100)
(NASA-CR-154119; JPL-Publ-77-19) Avail: NTIS HC A06/MF A01 CSCL 08I

The borehole hydraulic coal mining system accesses the coal seam through a hole drilled in the overburden. The mining device is lowered through the hole into the coal seam where it fragments the coal with high pressure water jets which pump it to the surface as a slurry by a jet pump located in the center of the mining device. The coal slurry is then injected into a pipeline for transport to the preparation plant. The system was analyzed for performance in the thick, shallow coal seams of Wyoming, and the steeply pitching seams of western Colorado. Considered were all the aspects of the mining operation for a 20-year mine life, producing 2,640,000 tons/yr. Effects on the environment and the cost of restoration, as well as concern for health and safety, were studied. Assumptions for design of the mine, the analytical method, and results of the analysis are detailed.
Author

N77-28559# Lockheed Missiles and Space Co., Palo Alto, Calif.
SOIUZ-22: A NEW CONTRIBUTION TO SPACE GEOGRAPHY
V. V. Ivanov and E. D. Sulidi-Kondrat'ev [1977] 2 p Transl. into ENGLISH from Priroda (Moscow), no. 3, 1977 p 21
Avail: NTIS HC A02/MF A01: National Translation Center, John Crerar Library, Chicago, Ill. 60616

The use of space photographs in the detection of earth resources and discontinuous tectonics is evaluated. I.M.

N77-28560*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
RADAR SYSTEMS FOR A POLAR MISSION, VOLUME 1
R. K. Moore, J. P. Claassen, R. L. Erickson, R. K. T. Fong, M. J. Komen, J. McCauley, S. B. McMillan, and S. K. Parashar Feb. 1977 89 p refs
(Contract NAS5-22325)
(NASA-CR-152510; RSL-TR-291-2-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 08H

The application of synthetic aperture radar (SAR) in monitoring and managing earth resources is examined. Synthetic aperture radars form a class of side-looking airborne radar, often referred to as coherent SLAR, which permits fine-resolution radar

imagery to be generated at long operating ranges by the use of signal processing techniques. By orienting the antenna beam orthogonal to the motion of the spacecraft carrying the radar, a one-dimensional imagery ray system is converted into a two-dimensional or terrain imaging system. The radar's ability to distinguish - or resolve - closely spaced transverse objects is determined by the length of the pulse. The transmitter components receivers, and the mixer are described in details. Author

N77-28561*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

RADAR SYSTEMS FOR A POLAR MISSION, VOLUME 2 Final Report

R. K. Moore, J. P. Claassen, R. L. Erickson, R. K. T. Fong, B. C. Hanson, M. J. Komen, S. B. McMillan, and S. K. Parashar Jun. 1976 117 p refs

(Contract NAS5-22384)

(NASA-CR-152511; RSL-TR-291-2-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 08H

For abstract, see N77-28560.

N77-28562# Swedish Space Corp., Solna.

QUICK-LOOK CAPABILITY IN A EUROPEAN EARTH RESOURCES SATELLITE DATA NETWORK Final Report

15 Apr. 1977 152 p refs

(Contract ESA-SC/128-HQ)

(FU15-4) Avail: NTIS HC A08/MF A01

The Swedish satellite data processing system is analyzed to identify user requirements for quick-look data in the area covered by the planned European network, and to assess the elements required for an optimum quick-look system to meet user requirements within the planned network. Author

N77-28563*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

REMOTE WATER MONITORING SYSTEM Patent Application

David C. Grana and David P. Haynes, inventors (to NASA) Filed 4 Aug. 1977 20 p

(NASA-Case-LAR-11973-1; US-Patent-Appl-SN-821681) Avail: NTIS HC A02/MF A01 CSCL 08H

A remote water monitoring system is described that integrates the functions of sampling, sample preservation, sample analysis, data transmission and remote operation. The system employs a floating buoy carrying an antenna connected by lines to one or more sampling units containing several sample chambers. Receipt of a command signal actuates a solenoid to open an intake valve outward from the sampling unit and communicates the water sample to an identifiable sample chamber. Such response to each signal receipt is repeated until all sample chambers are filled in a sample unit. Each sample taken is analyzed by an electrochemical sensor for a specific property and the data obtained is transmitted to a remote sending and receiving station. Thereafter, the samples remain isolated in the sample chambers until the sampling unit is recovered and the samples removed for further laboratory analysis. Author

N77-28564*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

REMOTELY SENSED AND LABORATORY SPECTRAL SIGNATURES OF AN OCEAN-DUMPED ACID WASTE

Beverly W. Lewis and Vernon G. Collins Washington Jul. 1977 38 p refs

(NASA-TN-D-8467; L-11373) Avail: NTIS HC A03/MF A01 CSCL 13B

An ocean-dumped acid waste plume was studied by using a rapid scanning spectrometer to remotely measure ocean radiance from a helicopter. The results of these studies are presented and compared with results from sea truth samples and laboratory experiments. An ocean spectral reflectance signature and a laboratory spectral transmission signature were established for the iron-acid waste pollutant. The spectrally and chemically significant component of the acid waste pollutant was determined to be ferric iron. Author

N77-28565# Army Electronics Command, Fort Monmouth, N. J.

EFFECTS OF CLOUD PARTICLES ON REMOTE SENSING FROM SPACE IN THE 10-MICROMETER INFRARED REGION

Richard D. H. Low Jan. 1977 55 p refs

(AD-A038502; ECOM-5811) Avail: NTIS HC A04/MF A01 CSCL 17/3

This report describes the derivation of the radiative transfer equation and its solution by the Gauss-Seidel iteration method. On the basis of microphysical and climatological considerations, four cloud models representing one stratus type and three cumulus types were investigated as to their optical properties and the thickness requirements for blackbody radiation. Findings are as follows: (1) Reflection in the 10-micrometer infrared region is negligible; (2) Given the same microstructure, a cloud appears more black in the windows of the 11- to 13-micrometer region than in any other windows in this infrared region; (3) In satellite work, cloud emissivity (or transmissivity) should be calculated on the basis of upwelling radiances; and (4) Cloud liquid water content may be a better parameter in defining thickness requirement for blackbody radiation. GRA

N77-28566# National Environmental Satellite Service, Washington, D. C.

NOAA PROGRAM DEVELOPMENT PLAN FOR SEASAT-A RESEARCH AND APPLICATIONS

Mar. 1977 97 p refs

(PB-265414/3; NOAA-77030210) Avail: NTIS HC A05/MF A01 CSCL 22B

A program development plan is written for marine applications of NASA's SEASAT-A spacecraft, designed for launch in 1978. SEASAT-A is the first space research platform dedicated to ocean science and application. Specific objectives are: (1) explore, map, and chart the global ocean and its living resources; (2) manage, use, and conserve those resources; (3) describe, monitor, and predict conditions in the atmosphere, ocean, sun, and space environment;(4) issue warnings against impending destructive natural events; (5) develop beneficial methods of environmental modification; and (6) assess the consequences of inadvertent environmental modification over a period of time. GRA

N77-28567# Naval Postgraduate School, Monterey, Calif.

A PHOTOGRAPHIC RECONNAISSANCE OF THE MICRORELIEF IN THE MONTEREY AND CARMEL SUBMARINE CANYONS, CALIFORNIA M.S. Thesis

John Alexander Jensen Dec. 1970 143 p refs

(AD-A039370) Avail: NTIS HC A07/MF A01 CSCL 08/10

Over 500 underwater photographs were taken in the Monterey and Carmel submarine canyons for the purpose of studying their microrelief. The pictures indicated that a variety of biological and physical differences exist not only within each canyon but also between the two nearby canyons. In Monterey Canyon are to be found fine grain sediments which have been very actively churned by benthic organisms. Few rock outcrops were noted, and definitive evidence of current activity in the form of ripple marks was observed in only one region. Carmel Canyon included generally coarser grain material than Monterey Canyon and showed a marked absence of active burrowing. A large number of rock outcrops was observed and there appeared to be extensive current activity throughout most of the canyon. Author (GRA)

N77-28568# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.

SEASONAL VARIATIONS IN GREAT LAKES DESIGN WAVE HEIGHTS: LAKE ERIE Final Report, Feb. - Oct. 1976

Donald T. Resio, Rebecca M. Brooks, and Charles L. Vincent Mar. 1977 85 p refs

(AD-A039153; WES-MP-H-76-21) Avail: NTIS HC A05/MF A01 CSCL 04/2

Tables of 5-day extremal parameters are presented, along with a methodology for the calculation of design wave heights for variable intervals of time during the year. A brief description of the Great Lakes Climatology is included to provide a meteorological context for the wave height variations throughout the year. Author (GRA)

N77-28569# Institute for Defense Analyses, Arlington, Va. Program Analysis Div.

OPTIMAL DRAWDOWN STRATEGY FOR STRATEGIC PETROLEUM RESERVES

Robert E. Kuene, Jerry Blankenship, and Paul F. McCoy Apr. 1977 150 p refs
(Contract FEA-CR-02-60857-00)
(PB-265838/3; IDA-P-1252; IDA/ HQ-77-19019; FEA/B-77/142) Avail: NTIS HC A07/MF A01 CSCL 21D

The problem addressed is if the United States had a reserve of petroleum of a given size to be used in case of an oil embargo, how should that petroleum be drawn from the reserve when an embargo actually occurs. The objective is to find a drawdown policy which maximizes the present value of total GNP benefits from petroleum drawn from the reserve minus the opportunity costs of holding the petroleum in storage. GRA

N77-28570# Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
RECLAMATION RESEARCH IN THE SEVENTIES Progress Report
1977 108 p refs
(PB-266257/3; RR-28; PR-2) Avail: NTIS HC A06/MF A01 CSCL 13B

The congressionally funded water resources research programs, including the major research activities of the seven regional offices of the Bureau of Reclamation and those of the Engineering and Research (E&R) Center in Denver are summarized. GRA

N77-28571# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
LAKE ST. CLAIR HYDROLOGIC TRANSFER FACTORS
Frank H. Quinn Jul. 1976 22 p refs
(PB-266420/9; NOAA-TM-ERL-GLERL-10; NOAA-77032904) Avail: NTIS HC A02/MF A01 CSCL 08H

Monthly hydrologic transfer factors were developed for Lake St. Clair to aid in the comparison and coordination of St. Clair and Detroit River monthly flows. The transfer factor is defined as the sum of the monthly precipitation and runoff minus the evaporation and change in storage. Each of the hydrologic constituents were determined independently from available data. GRA

N77-28572# Ecology Consultants, Inc., Fort Collins, Colo.
GUIDE TO LAND COVER AND USE CLASSIFICATION SYSTEMS EMPLOYED BY WESTERN GOVERNMENTAL AGENCIES Final Report
Scott L. Ellis, Colling Fallat, Nancy Reece, and Carol Riordan Mar. 1977 190 p refs Sponsored in part by EPA, Washington D. C.
(Contract DI-14-16-0008-2123)
(PB-265173/5; ECI-293; FWS/OBS-77/05) Avail: NTIS HC A09/MF A01 CSCL 13B

The classification systems are listed that are in use by state and Federal agencies in 18 western states and the provinces of Alberta and Manitoba in Canada. The guide--limited primarily to wildlife, land use, and terrestrial vegetation--provides summary descriptions of classification systems, and the data base and the techniques required to implement these systems. System descriptions are divided into three sections: local systems, regional and multi-regional systems, plus some Canadian systems. Each system summary includes the title of the system, contact person, objectives, background, description, products and related systems. Author and keyword indexes and a glossary of terms are included. GRA

N77-28573# Federal Energy Administration, Washington, D. C. Office of Oil and Gas Analysis.
PETROLEUM SITUATION REPORTS 1974-1975 Monthly Petroleum Statistics Report
Mar. 1977 94 p
(PB-265848/2; FEA/B-77/106) Avail: NTIS HC A05/MF A01 CSCL 21D

Graphs detailing total imports, crude oil runs-to-stills, apparent demand for motor gasoline, and motor gasoline stocks; tables indicating total demand for petroleum products; imports of refined products; production, imports, demand and stocks of crude oil, motor gasoline, jet fuels, distillate fuel oil and residual fuel oil, are presented. GRA

N77-28574# Aeronutronic Ford Corp., Newport Beach, Calif. Aeronutronic Div.
REMOTE MONITORING OF NITRIC OXIDE BY GAS-FILTER CORRELATION TECHNIQUES Final Report, Jun. 1973 - Jun. 1976
Darrell E. Burch and David A. Gryvnak Nov. 1976 81 p refs
(Contract EPA-68-02-0766)
(PB-265455/6; U-6252; EPA-600/2-76-277) Avail: NTIS HC A05/MF A01 CSCL 14B

The feasibility of remotely monitoring the concentration of nitric oxide (NO) in the effluent of industrial stacks has been investigated analytically and experimentally in the laboratory. The type of instrument considered employs two or more gas-filter cells that contain different amounts of NO. Radiant energy emitted by the hot gas in the effluent is measured after it has passed either through one of the gas filter cells or through a neutral density filter. By comparing the amounts of energy received through each of the filters, it is possible to determine the concentration of NO in the presence of a moderate amount of continuum emitting material such as small particles. GRA

N77-28575# Battelle Columbus Labs., Ohio.
PRODUCTION AND PROCESSING OF US TAR SANDS: AN ENVIRONMENTAL ASSESSMENT Final Report
N. A. Frazier, D. W. Hissong, W. E. Ballantyne, and E. J. Nazey Dec. 1976 92 p refs
(Contract EPA-68-02-1323)
(PB-266266/6; EPA-600/7-76-035) Avail: NTIS HC A05/MF A01 CSCL 08I

Factors traceable to the increasing shortfall in U.S. production of natural crude have rekindled interests in U.S. tar sands as a sources of synthetic fuel. Reported are the results of a preliminary study to assess the potential primary environmental impacts of production and processing of U.S. tar sands bitumen. With the possible exception attributable to chemical differences between tar sand bitumen and coal, potential environmental impacts of producing tar sands by mining methods would be similar in type to those of mining coal by the same method and in the same area as the tar sand deposit. Processes for extracting bitumen from the mined tar sand would generate solid waste in the form of spent sand. Constituents and quantities of emissions to air and water are process dependent but existing control technology and good environmental practices are technically applicable. A viable in situ production technology for producing tar sand reservoirs has not yet been demonstrated. On the basis of methods tested to date, potential environmental impacts of producing tar sands by in situ methods would be very similar to those of conventional oil field production. Technical and economic factors will determine if in situ methods, or possibly underground methods, are an alternative to surface mining in environmentally sensitive areas. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N77-28576# Aeronautical Research Labs., Melbourne (Australia).
HYDROCARBON FUELS FROM SOLAR ENERGY VIA THE ALGA BOTRYOCOCCUS BRAUNI
L. W. Hillen and D. R. Warren Jul. 1976 47 p refs
(ARL/Mech. Eng.-148) Copyright. Avail: Issuing Activity

The production of liquid hydrocarbon fuels from a non-depleting source such as solar energy and algae is investigated. The alga Botryococcus braunii, which grows widely in nature, can produce hydrocarbons in amounts up to 75% of its dry mass. There is considerable contemporary and geological evidence, especially in Australia, that it is capable of prolific growth under

appropriate conditions. Harvesting and processing is relatively simple compared with other energy crops. Problems involved in producing solar oil in this way on a large scale are assessed.
Author

N77-28577*+ National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ANNOTATED BIBLIOGRAPHY, VOLUME 1, APPENDIX 2
Sandra J. Blow Jul. 1977 848 p
(NASA-TM-74765; BIB.74-01-Vol-1-App-2) Avail: NTIS HC A99 CSCL 05B

Abstracts of reports concerning energy are presented. The topics reported conclude: energy and power, hydrogen and other fuels, waste heat utilization, nuclear, solar, and energy storage.
F.O.S.

N77-28578*+ National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ANNOTATED BIBLIOGRAPHY, VOLUME 2, APPENDIX 2
Sandra J. Blow Jul. 1977 874 p
(NASA-TM-74764; BIB.74-01-Vol-2-App-2) Avail: NTIS HC A99 CSCL 05B

For abstract, see N77-28577.

N77-28579*# Battelle Columbus Labs., Ohio.
EVALUATION OF SELECTED CHEMICAL PROCESSES FOR PRODUCTION OF LOW-COST SILICON, PHASE 2 Quarterly Progress Report, 1 Apr. - 30 Jun. 1977
J. M. Blocher, Jr., M. F. Browning, W. J. Wilson, and D. C. Carmichael 20 Jul. 1977 33 p refs Prepared for JPL Sponsored in part by ERDA
(Contracts NAS7-100; JPL-954339)
(NASA-CR-153907; QPR-7; ERDA/JPL-754339-77/7) Avail: NTIS HC A03/MF A01 CSCL 10A

Potential designs for an integrated fluidized-bed reactor/zinc vaporizer/SiCl4 preheater unit are being considered and heat-transfer calculations have been initiated on versions of the zinc vaporizer section. Estimates of the cost of the silicon prepared in the experimental facility have been made for projected capacities of 25, 50, 75, and 100 metric ton of silicon. A 35 percent saving is obtained in going from 25 metric ton/year to the 50 metric ton/year level. This analysis, coupled with the recognition that use of two reactors in the 50 metric ton/year version allows for continued operation (at reduced capacity) with one reactor shut down, has resulted in a recommendation for adoption of an experimental facility capacity of 50 metric ton/year or greater. At this stage, the change to a larger size facility would not increase the design costs appreciably. In the experimental support program, the effects of seed bed particle size and depth were studied, and operation of the miniplant with a new zinc vaporizer was initiated, revealing the need for modification of the latter.
Author

N77-28580*# General Electric Co., Philadelphia, Pa. Space Div.
THE 200 WATTS/KILOGRAM SOLAR ARRAY CONCEPTUAL APPROACH STUDY. PHASE 2: ASSESSMENT REPORT FOR PROOF-OF-CONCEPT EXPERIMENTS AND HALLEY'S COMET CONCENTRATOR ARRAY
8 Jul. 1977 56 p Prepared for JPL
(Contract JPL-954393)
(NASA-CR-153938; Rept-200W/KG-7-77-048) Avail: NTIS HC A04/MF A01 CSCL 10A

The activities associated with the fabrication, handling, and testing of 2-mil solar cell modules on a flexible substrate are demonstrated. It is shown that 2-mil solar cells can be reliably handled, welded, and bonded to a Kapton substrate. Flexible Invar interconnects can be used to interconnect individual cells to form modules. These solar cell modules can be temperature cycled, wrapped around a 10-inch diameter drum, and vibrated to the shuttle environment with no significant damage. A bonding technique was developed to physically join adjacent modules that is stronger than the Kapton, itself. Ultraviolet radiation tests were performed on RTV - silicone as a cell cover material - with very encouraging results.
Author

N77-28581*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MODELING OF FLUIDIZED BED SILICON DEPOSITION PROCESS
K. Kim, G. Hsu, R. Lutwack, and A. Praturi 15 Jun. 1977 47 p refs
(Contract NAS7-100)
(NASA-CR-154120; JPL-Publ-77-25) Avail: NTIS HC A03/MF A01 CSCL 10A

The model is intended for use as a means of improving fluidized bed reactor design and for the formulation of the research program in support of the contracts of Silicon Material Task for the development of the fluidized bed silicon deposition process. A computer program derived from the simple modeling is also described. Results of some sample calculations using the computer program are shown.
Author

N77-28582*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OPTIONS FOR DEMONSTRATING THE USE OF SOLAR ENERGY IN CALIFORNIA BUILDINGS
E. S. Davis and G. Yanow Sep. 1976 33 p refs
(Contract NAS7-100)
(NASA-CR-154103; JPL-Publ-77-33) Avail: NTIS HC A03/MF A01 CSCL 10A

Three programmatic options for demonstrating the most economically attractive applications of solar energy to buildings located in California are formulated. The unique characteristics of solar energy demonstration programs and the involvement of key decision makers are discussed in detail. The demonstration programs are related to specific purposes. The priority structure used to select the generic projects making up each program is discussed in relationship to the purposes of the program. In addition, some implications of the nature of the demonstration program for management are outlined.
Author

N77-28583*# National Aeronautics and Space Administration. Pasadena Office, Calif.
A NON-TRACKING SOLAR ENERGY COLLECTOR SYSTEM Patent Application
M. Kudret Selcuk, inventor (to NASA) Filed 27 May 1977 17 p
(Contract NAS7-100)
(NASA-Case-NPO-13817-1; US-Patent-Appl-SN-801452) Avail: NTIS HC A02/MF A01 CSCL 10A

A solar energy collector system characterized by an improved concentrator for directing incident rays of solar energy on parallel strip-like segments of a flat-plate receiver is described. A plurality of individually mounted reflector modules of a common asymmetrical triangular cross-sectional configuration is supported for independent reorientation. A plurality of asymmetric vee-trough concentrators for deflecting incident solar energy toward the receiver is defined.
NASA

N77-28584*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SOLAR POND Patent Application
Charles G. Miller and James B. Stephens, inventors (to NASA) Filed 30 Jun. 1977 17 p
(Contract NAS7-100)
(NASA-Case-NPO-13581-2; US-Patent-Appl-SN-811815) Avail: NTIS HC A02/MF A01 CSCL 10A

Narrow elongated trenches, grouped together over a wide area, can be formed by bulldozer type equipment. Each trench is lined with a heat-absorbing black liner. The liquid in the bottom of each trench, used to absorb the solar energy, may be a brine solution or plain water, depending on the means used to remove the thermal energy from the pond. The heat-absorbing liquid is kept separate from the thermal energy removing fluid by means such as clear polyethylene material. The covering for the pond may be a fluid or solid, if the covering is a fluid, fire fighting foam, continuously generated, or siloons are used to keep the surface covering clean and insulated. If the thermal energy removing fluid is a gas, a fluid insulation layer contained in a flat polyethylene tubing is used to cover the pond. The side of the tube directed towards the sun is treated to block out ultraviolet radiation and trap infrared radiation.
Author

N77-28585*# National Aeronautics and Space Administration. Pasadena Office, Calif.

A SOLAR ARRAY STRIP AND A METHOD FOR FORMING THE SAME Patent Application

Robert L. Mueller and Robert K. Yasui, inventors (to NASA) Filed 24 Jun. 1977 14 p

(Contract NAS7-100)

(NASA-Case-NPO-13652-1; US-Patent-Appl-SN-809890) Avail: NTIS HC A02/MF A01 CSCL 10A

Printed circuitry is placed in a sandwiched relation with a pair of flexible layers of non-conductive material. Solder pads are deposited on the printed circuitry and the resulting substrate is stored on a drum. The substrate is withdrawn from the drum and incrementally advanced along a linear path. Solderless solar cells are serially transported into engagement with the pads and thereafter the pads are heated for attachment of the cells to the circuitry. Excess flux is cleaned from the solar cells, and the cells are encapsulated in a protective coating. The resulting array is spirally wound on a drum. NASA

N77-28586*# Rasor Associates, Inc., Sunnyvale, Calif.

THE PLASMATRON: ADVANCED MODE THERMIONIC ENERGY CONVERSION

L. K. Hansen, G. L. Hatch, and N. S. Rasor Nov. 1976 65 p refs

(Contract NAS3-19861)

(NASA-CR-135139; NSR-5-1) Avail: NTIS HC A04/MF A01 CSCL 10A

A theory of the plasmatron was developed. Also, a wide range of measurements were obtained with two versatile, research devices. To gain insight into plasmatron performance, the experimental results are compared with calculations based on the theoretical model of plasmatron operation. Results are presented which show that the plasma arc drop of the conventional arc (ignited) mode converter can be suppressed by use of an auxiliary ion source. The improved performance, however, is presently limited to low current densities because of voltage losses due to plasma resistance. This resistance loss could be suppressed by an increase in the plasma electron temperature or a decrease in spacing. Plasmatron performance characteristics for both argon and cesium are reported. The argon plasmatron has superior performance. Results are also presented for magnetic cutoff effects and for current distributing effects. These are shown to be important factors for the design of practical devices.

Author

N77-28587*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

POLYMERIC MEMBRANE SYSTEMS OF POTENTIAL USE FOR BATTERY SEPARATORS

Warren H. Philipp Washington Jul. 1977 15 p refs

(NASA-TM-X-3567; E-9092) Avail: NTIS HC A02/MF A01 CSCL 10A

Two membrane systems were investigated that may have potential use as alkaline battery separators. One system comprises two miscible polymers: a support polymer (e.g., polyvinyl formal) and an ion conductor such as polyacrylic acid. The other system involves a film composed of two immiscible polymers: a conducting polymer (e.g., calcium polyacrylate) suspended in an inert polymer support matrix, polyphenylene oxide. Resistivities in 45-percent potassium hydroxide and qualitative mechanical properties are presented for films comprising various proportions of conducting and support polymers. In terms of these parameters, the results are encouraging for optimum ratios of conducting to support polymers. Author

N77-28588*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RELATION OF MORPHOLOGY OF ELECTRODEPOSITED ZINC TO ION CONCENTRATION PROFILE

Charles E. May, Harold E. Kautz, and Brian B. Sabo Washington Jul. 1977 34 p refs

(NASA-TN-D-8527; E-9079) Avail: NTIS HC A03/MF A01 CSCL 10C

The morphology of electrodeposited zinc was studied with special attention to the ion concentration profile. The initial concentrations were 9M hydroxide ion and 1.21M zincate. Current densities were 6.4 to 64 mA/sq cm. Experiments were run with a horizontal cathode which was observed in situ using a microscope. The morphology of the zinc deposit was found to be a function of time as well as current density; roughly, the log of the transition time from mossy to large crystalline type deposit is inversely proportional to current density. Probe electrodes indicated that the electrolyte in the cathode chamber was mixed by self inducted convection. However, relatively large concentration gradients of the involved species existed across the boundary layer of the cathode. Analysis of the data suggests that the morphology converts from mossy to large crystalline when the hydroxide activity on the cathode surface exceeds about 12 M. Other experiments show that the pulse discharge technique had no effect on the morphology in the system where the bulk concentration of the electrolyte was kept homogeneous via self induced convection. Author

N77-28589# Wisconsin Univ., Madison.

DESIGN PROCEDURE FOR SOLAR AIR HEATING SYSTEMS

S. A. Klein, W. A. Beckman, and J. A. Duffie 1976 9 p refs Presented at the Joint Conf. of the Am. Section of the Intern. Solar Energy Soc. and the Solar Energy Soc. of Canada, Inc., Winnipeg, Manitoba, Canada, 15 Aug. 1976

(Contract EY-76-S-02-2588)

(CONF-760842-14) Avail: NTIS HC A02/MF A01

A solar air heating system incorporating a flat-plate air heater and packed bed thermal storage is described and a simulation model for the system is developed. The results of many simulations of the air heating system are used to establish the relationship between system performance and the system design and meteorological variables. The results are presented in analytic and graphical form, referred to as an f-chart for solar air heating systems. The results of simulations, in several widely different climates suggest that the information presented in the f-chart is location independent. Methods of estimating the performance of air heating systems having a collector air capacitance rate and a storage capacity other than those used to generate the f-chart are included. ERA

N77-28590# Aerospace Corp., Germantown, Md. Environment and Energy Conservation Div.

GEOTHERMAL ENERGY, AN ENVIRONMENTAL AND SAFETY MINI-OVERVIEW SURVEY

Jul. 1976 134 p refs

(Contract E(04-3)-1101)

(ATR-77(7518)-1) Avail: NTIS HC A07/MF A01

A survey is presented in order to determine the technology status, gaps, and needs for research and development programs in the environment and safety areas of this resource. The information gathered from a survey of geothermal energy development undertaken to provide background for an environment and safety overview program is summarized. A technology assessment for resource development is presented. The three specific environmental problems identified as most potentially limiting to geothermal development; hydrogen sulfide control, brine disposal, and subsidence, are discussed. Current laws, regulations, and standards applying to geothermal systems are summarized. The elements of the environment, health, and safety program considered to be intrinsically related to the development of geothermal energy systems are discussed. Interagency interfaces are touched on briefly. ERA

N77-28591# Sandia Labs., Albuquerque, N. Mex.

TOTAL ENERGY SYSTEMS: SOLAR ENERGY PROGRAM Semi Annual Review, Jul. 1976

Robert L. Alvis and Robert L. SanMartin Jul. 1976 186 p refs

(Contract E(29-1)-789)

(SAND-76-5758) Avail: NTIS HC A09/MF A01

Reviews are presented on the ERDA-New Mexico irrigation project, total energy program, solar total energy campus study, solar total energy test facility (including operating experience with parabolic cylindrical collector field), solar total energy project management, and mirror materials and selective optical coatings. ERA

N77-28592# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.

COOLING SUBSYSTEM DESIGN IN CUS SOLAR HOUSE 3

D. S. Ward, T. Uesaki, and G. O. G. Loef Aug. 1976 23 p
(Contract EY-76-S-02-2858)
(COO-2858-1; Conf-760842-20) Avail: NTIS
HC A02/MF A01

The use of cooling storage in conjunction with lithium bromide adsorption chillers allows for improved operating conditions of the cooling subsystem. Significant performance degradation in the absorption cooling capacity is evident whenever the chiller cycles are on and off during periods of low cooling demand. The capability of providing storage for the chiller output prevents short-term cycling of the absorption machine and significantly improves the seasonal average coefficient of performance of the cooling subsystems. Cool storage can also be utilized to allow for a lower cooling capacity of the absorption unit (lower tonnage), without decreasing the ability of the subsystem to meet the cooling demands of the building. ERA

N77-28593# California Univ., Livermore. Lawrence Livermore Lab.
BIOSOLAR SYNFUELS FOR TRANSPORTATION
Carl J. Anderson 17 Jan. 1977 17 p refs
(Contract W-7405-eng-48)
(UCRL-52208) Avail: NTIS HC A02/MF A01

A short review is given of biosolar sources of synthetic liquid fuels (synfuels) for transportation. There are a variety of ways to convert potentially large energy crops into fuels suitable for transportation use; e.g., liquid fuels such as methanol, ethanol, and pyrolytic oils. In addition, organic wastes are widely produced, and although they are still generally not considered a resource, there is little doubt that they will increasingly be recycled for their material and energy value. Major technical, social, economic, environmental, and political questions remain, and although the potential for biosolar transportation synfuels is large, it is still small compared to transportation energy demand. Because of their costs, early implementation of biosolar conversion schemes will likely not be in the area of transportation synfuels. ERA

N77-28594# California Univ., Berkeley. Lawrence Berkeley Lab.
PROCESSING OF POLYCRYSTALLINE GaAs SOLAR CELLS
R. C. DeBernardy-Sigoyer Dec. 1976 73 p refs
(Contract W-7405-eng-48)
(LBL-5712) Avail: NTIS HC A04/MF A01

Thesis GaAs was deposited on substrate materials by chemical vapor deposition from trimethyl gallium and arsine in a hydrogen carrier gas. The microstructural and electrical properties of the films were studied to determine the effects of the different substrate materials on film and interfacial properties. Of particular interest were the grain size and growth morphology of GaAs crystallites, the interfacial reaction products formed between the GaAs and the metal during growth, and the resulting electrical contact resistance between the film and metal. ERA

N77-28595# California Univ., Berkeley. Lawrence Berkeley Lab.
STRATEGIC PLANS FOR ENERGY RESEARCH AND DEVELOPMENT, FY 1976 - FY 1981
Sep. 1976 66 p refs
(Contract W-7405-eng-48)
(TID-27291) Avail: NTIS HC A04/MF A01

This guidance charts the course for the future direction for the Lawrence Berkeley Laboratory (LBL). ERDA approves the following institutional aspects for LBL: (1) LBL would maintain its strong capability in present basic science programs, but redirect and expand its activities on a selective basis into applied research and technology-developed programs with a goal of achieving a level of activity in these new programs comparable to those of the basic program, and (2) these applied programs would provide a basis of support for ERDA project management teams managing engineering development and demonstration projects. Three important actions that the Lawrence Berkely Laboratory must undertake as it evolves into this new role are delineated, namely: to collaborate with engineering colleges and various social science departments at the Univ. of California Berkeley Campus; increase its contacts with industry, utilities, and state governments; and participate with the San Francisco ERDA Operations Office and ERDA Program offices in project management responsibilities. Developmental work being performed at LBL is described for the various areas and disciplines. GRA

N77-28596# Energy Research and Development Administration, Washington, D.C. Div. of Transportation Energy Conservation.
HYDROGEN-VIA-ELECTRICITY: A CANDIDATE TRANSITIONAL TRANSPORTATION ENERGY SYSTEM CONCEPT
W. J. D. Escher Sep. 1976 89 p refs
(ERDA-77-13; TEC-77/001; PT-67) Avail: NTIS
HC A05/MF A01

There is an expressed need to move transportation off oil. However, the stategic alternatives for creating a nonpetroleum energy base for transportation are all long-term, extremely costly systems (hydrocarbon synfuels, electricity, hydrogen energy), each having technical and socio-economic limitations and constraints which will govern their relative contributions. To preserve the options while conducting positive steps to obviate the possibility of energy shortfalls affecting transportation in the meanwhile, a transitional transportation energy systems approach may be needed. A candidate concept, Hydrogen-via-Electricity (HVE), is described in terms of criteria for such a system, and also related to each of the strategic alternatives to establish compatibility. If implemented, the HVE Concept has the near-term potential for supporting a certain fraction of the energy needs of the following transportation subsectors: railroads, intercity trucking, urban and intercity buses, and selected fleet vehicle systems. ERA

N77-28597# Energy Research and Development Administration, Washington, D.C. Div. of Solar Energy.
NATIONAL PROGRAM PLAN FOR RESEARCH AND DEVELOPMENT IN SOLAR HEATING AND COOLING
Nov. 1976 196 p refs
(ERDA-76-144) Avail: NTIS HC A09/MF A01

This interim report on a National Program Plan for Research and Development in Solar Heating and Cooling is based on a thorough assessment of the present status of solar heating and cooling technology and presented with the confidence that the emerging solar energy industry will continue to conduct a broad range of R and D activities. This plan describes the Federal R and D program plan for solar heating and cooling, including those activities to be funded in whole or in part by the Federal Government. The program plan is compatible with, but more detailed than, that described in the National Plan for Solar Heating and Cooling, ERDA 23A. It is intended that this interim report be circulated widely for review and comment by all those concerned with the R and D aspects of solar heating and cooling. ERA

N77-28598# Electric Power Research Inst., Palo Alto, Calif.
ELECTRIC UTILITY SOLAR ENERGY ACTIVITIES, 1976 SURVEY
L. D. Cleary Jan. 1977 83 p
(EPRI-ER-321-SR) Avail: NTIS HC A05/MF A01

The results of a survey to determine the scope and extent of solar energy projects sponsored by electric utilities are presented. Brief descriptions of the active operations along with information contacts are listed for each participating utility. Included for cross-reference is a list of the utilities involved with projects designated by category and an address list of the utilities. ERA

N77-28599# Brookhaven National Lab., Upton, N. Y.
BRIEFING BOOK ON THE ENERGY SITUATION IN NEW ENGLAND
Joel P. Brainard, James S. Munson, and Philip F. Palmedo Oct. 1976 138 p refs
(Contract EY-76-C-02-0016)
(BNL-21918) Avail: NTIS HC A07/MF A01

This briefing book is designed to give a concise overview of the facts of the energy situation in New England and of attitudes within the region towards current energy issues. Many of the central problems of U.S. energy policy are manifested in the region in a magnified form. The region entered the period of energy shortages and increasing prices in an economically declining condition. Energy prices were already high in 1970, 30% higher than rest of the country; the difference increased to 38% by 1974. With essentially no indigenous energy resources, New England is an energy-importing region. For various reasons

it is also more dependent on petroleum than other regions of the country and, at the same time, distant from domestic petroleum-producing regions. The result is that over 60% of the fuels it consumes are also imported from abroad. Although the future supply of energy to the region is critically dependent on energy-resource policies, policies related for example to coal and oil shale development, the region's concerns cluster around policies and technologies that are perceived to have a more direct impact on its energy welfare. Thus, energy conservation, solar energy, nuclear power, offshore oil development and, in general, the price of energy to the region are paramount issues of concern and debate. Following the Introductory chapter, these issues are discussed in four additional chapters: The Energy Situation in New England; Regional Energy Issues; Energy-Related Institutions; and State Legislation. ERA

N77-28600# Brookhaven National Lab., Upton, N. Y.
HYDROGEN PRODUCTION AND STORAGE IN UTILITY SYSTEMS Semiannual Progress Report, Jul. - 31 Dec. 1975
F. J. Salzano Jan. 1976 79 p refs
(Contract EY-76-C-02-0016)
(BNL-50590) Avail: NTIS HC A05/MF A01

A conceptual design of an electric storage system has been developed. Break-even cost data for introducing electric storage devices into the national energy system have been developed. Six materials were evaluated as substitutes for asbestos in the alkaline cell for use in 20 to 30 percent KOH at 150 to 160 C. Three of these look promising. Tests were conducted on the largest hydride test bed (84 lb granular FeTi) to determine the length of time various flow rates could be sustained. In the Hydrogen Technology Advanced Components Test System, design specifications and cost goals based on small-scale tests and analysis have been established for the storage components. Design specifications and cost goals have also been established for electrolyzer components. Several compositions of the TiFe/sub y/MN/sub z/H/sub x type were investigated. These compositions show greatly reduced dissociation and association pressures which subsequently may reduce the electrolysis unit and hydride storage vessel costs. ERA

N77-28601# Argonne National Lab., Ill.
SOLAR ENERGY AND ELECTRIC UTILITIES: CAN THEY BE INTERFACED?
Joseph G. Asbury and Ronald O. Mueller Aug. 1976 35 p refs
(Contract W-31-109-eng-38)
(ANL/ES-52) Avail: NTIS HC A03/MF A01

The economics of solar systems that interface with electricity supply systems are discussed. First, adopting the implicit assumption of many solar system designers of abundant supplies of low-cost off-peak electricity, systems studies of several of the more important solar energy applications are presented. It is shown that much of the electricity supply savings claimed for solar energy systems stem from the storage, rather than the solar, component of the system. Second, employing a standard economic representation of the periodic load problem, the general problem of interfacing solar energy and electric utility supply systems is examined. The general conclusion is that solar energy systems and conventional electric utility systems represent a poor technological match. The basic problem is that both technologies are very capital intensive. ERA

N77-28602# AiResearch Mfg. Co., Phoenix, Ariz.
PRELIMINARY DESIGN REVIEW: BRAYTON ISOTOPE POWER SYSTEM
[1976] 347 p refs
(Contract EY-76-C-03-1123)
(TID-27269) Avail: NTIS HC A15/MF A01

The design aspects covered include flight system design, design criteria/ margins/reliability, GDS design, system analysis, materials, system assembly procedure, and government furnished equipment-BTPS. ERA

N77-28603# Radian Corp., Austin, Tex.
SAMPLING STRATEGY AND CHARACTERIZATION OF POTENTIAL EMISSIONS FROM SYNFUEL PRODUCTION SYMPOSIUM
1976 152 p refs Symp. held at Austin, Tex., 8-10 Jun. 1976
(Contract W-7405-eng-26)
(CONF-760602) Avail: NTIS HC A08/MF A01

The rapidly increasing energy demand has brought increased emphasis on the conversion of coal and oil shale to fluid fuels. These solid fuels provide a significantly greater pollution potential than petroleum. For the conversion program to be successful, effort must be directed toward the establishment of meaningful emissions standards. Yet meaningful regulations cannot be established for these processes without reliable emission stream data that are not now available. While the need for stream composition data is widely recognized, the complexity of the technology and the absence of representative equipment combined with the need for complex sampling and analytical procedures have limited progress in data acquisition. GRA

N77-28604# Energy Research and Development Administration, Washington, D.C. Div. of Solar Energy.
NATIONAL PROGRAM FOR SOLAR HEATING AND COOLING OF BUILDINGS
Nov. 1976 63 p refs
(ERDA-76-6) Avail: NTIS HC A04/MF A01

The National Program presented in this report, reflects the results of continuing assessment of initial plans, additional program planning activities, and experience gained this past year by ERDA and other program participants. As a result of these undertakings, strategies and plans for the research, development and demonstration activities outlined in ERDA-23A have been updated. The status of those activities funded totally or partially by ERDA is presented. This report thus supercedes ERDA-23A. ERA

N77-28605# Energy Research and Development Administration, Washington, D.C.
CREATING ENERGY CHOICES FOR THE WESTERN REGION
1976 36 p Presented at 3rd Public Meeting on a Natl. Plan for Energy Res., Develop. and Demonstration, Denver, 17-18 May 1976
(ERDA-76/1-PM-3; Conf-760597) Avail: NTIS HC A03/MF A01

Regional meetings to provide the public with an opportunity to exchange information and opinions about Federal energy planning are discussed. Topics considered include: energy conservation, synthetic and fossil fuels technology development and commercialization, environmental and socio-economic impacts of energy resource development, solar and geothermal energy, and intensive electrification. A range of important, and often conflicting, opinions expressed on energy planning, funding priorities, and environmental impacts are summarized. ERA

N77-28606# ICF, Inc., Washington, D.C.
PROJECT INDEPENDENCE EVALUATION SYSTEM (PIES) DOCUMENTATION. VOLUME 6: METHODOLOGY FOR IMPROVING THE PRICE SENSITIVITY OF THE PIES OIL AND GAS SUPPLY CURVES
Washington FEA Sep. 1976 51 p refs
(Contract FEA-CO-05-50301-00)
(PB-264069/6; FEA/N-76/416-Vol-6) Avail: NTIS HC A04/MF A01 CSCL 10A

A methodology for improving the price sensitivity of the oil and gas supply models used in Project Independence analyses is examined. Emphasis is placed on the question of improving the responsiveness of supply from currently existing proved reserves to changes in output prices. GRA

N77-28607# ICF, Inc., Washington, D.C.
PROJECT INDEPENDENCE EVALUATION SYSTEM (PIES) DOCUMENTATION. VOLUME 7: METHODOLOGY FOR DEVELOPING MORE COMPLEX INVESTMENT AND PRODUCTION PROFILES IN THE FEA OIL AND GAS SUPPLY MODEL
Sep. 1976 24 p ref
(Contract FEA-CO-05-50301-00)
(PB-264649/5; FEA/N-76/417-Vol-7) Avail: NTIS HC A02/MF A01 CSCL 10A

The possibility of altering the oil and gas supply models to utilize more complex investment and production profiles, especially

in frontier oil and gas provinces is investigated. The assumptions used in the models with respect to timing of investment and production are acceptable for mature oil and gas provinces, but are less so for frontier production areas. Investment leadtimes and rates of production build-up are slower in virgin provinces, which leads to underpriced petroleum and overestimated production in these areas. GRA

N77-28608# Joint Publications Research Service, Arlington, Va.

SOME THOUGHTS ON OPTIMIZING LONG-DISTANCE HEAT TRANSPORT SYSTEMS AND THEIR STORAGE FACILITIES

P. Charroppin Dec. 1976 37 p Transl. into ENGLISH of an unpublished manuscript (France), Nov. 1975 46 p
(AD-A038253; CRREL-TL-568) Avail: NTIS HC A03/MF A01 CSCL 18/13

This document stems from the study of transport of heat produced in nuclear power reactors with a high enough rating to benefit by scale economy and relying on seasonal storage to flatten the production curve. It aims at optimizing such transport systems and is first of all a search for a simple mathematical method for determining immediately the optimal diameters and the corresponding costs. Author (GRA)

N77-28609# Northwestern Technological Inst., Evanston, Ill.

HEAT EXTRACTION FROM HOT, DRY ROCK MASSES Progress Report, 1 Feb. - 31 Jul. 1976

J. Weertman, J. D. Achenbach, Z. P. Bazant, J. Dundurs, L. M. Keer, T. Mura, and S. Nemat-Nasser Oct. 1976 186 p refs (Grant NSF AER-75-00187)
(PB-265116/4; NSF/RA-760395) Avail: NTIS HC A09/MF A01 CSCL 08I

Geothermal energy conversion processes are studied. The following subjects are treated: (1) analytic study of crack growth and shape; (2) finite element solution of geothermal energy extraction; (3) fluid flow through cracks; (4) model experiments; and (5) seismic detection of hydraulically induced fractures. GRA

N77-28610# Louisiana State Univ., Baton Rouge. Center for Wetlands Resources.

OIL AND GAS USE CHARACTERIZATION, IMPACTS, AND GUIDELINES

W. H. Conner, J. H. Stone, L. M. Bahr, V. R. Bennett, J. W. Day, Jr., and R. E. Turner Jun. 1976 160 p refs Sponsored in part by Louisiana State Planning Office, Baton Rouge, Coastal Resources Program; Louisiana Wildlife and Fisheries Commission, Baton Rouge; and Louisiana Coastal Commission, Baton Rouge
(PB-265267/5; LSU-T-76-006; NOAA-77021602) Avail: NTIS HC A08/MF A01 CSCL 08J

A nontechnical survey of oil and gas activities and their impacts on wetland, and a discussion of preliminary guidelines for optimizing production and minimizing impact are presented. GRA

N77-28611# Construction Engineering Research Lab. (Army), Champaign, Ill. Energy Branch.

MARKET EVALUATION STUDY: SOLAR DOMESTIC WATER HEATERS FOR DOD BARRACKS Final Report

Larry Walton Windingland, George Walton, and Douglas Hittle Feb. 1977 40 p refs
(Contract FEA-CG-05-50083-00)
(AD-A036479; CERL-TR-E-102) Avail: NTIS HC A03/MF A01 CSCL 13/1

This study assesses the potential market for solar domestic hot water systems in DOD bachelor enlisted and bachelor officer quarters (barracks). The number and locations of existing and planned bachelor enlisted and bachelor officer quarters in the United States are analyzed, and the locations where solar domestic water heating is most feasible are determined. Life-cycle costs of providing solar domestic water heating systems are analyzed and the DOD market potential for these systems determined for varying system costs. The results of more than 120 one-year solar hot water heating system simulations are presented along with a dimensionless graph and methodology which can be used to estimate solar hot water heater performance for building loads and sites other than those studied. The potential markets for solar collectors based on varying system costs are presented. Results indicate that at an anticipated future system cost of $9/sq ft ($97/sq m) of collector the probable market for solar collectors is 4.4 million sq ft (409,000 sq m). Over a 20-year life, the potential savings resulting from application of this collector area is estimated to be 4.5 million barrels of fuel and $29 million. Author (GRA)

N77-28612# Army Electronics Command, Fort Monmouth, N. J.

RECHARGEABLE METAL OXIDE-HYDROGEN CELLS

James E. Wynn Jan. 1977 22 p
(AD-A036280; ECOM-4465) Avail: NTIS HC A02/MF A01 CSCL 10/3

Electrically rechargeable nickel oxide-hydrogen cells (rated 1.0 amperehour) were fabricated using platinum catalyzed hydrogen anodes, nickel-oxide cathodes, and a two component separator system, Pellon/PKT, saturated with 30% KOH electrolyte. Also, silver oxide-hydrogen cells (rated 1.5 ampere-hours) were fabricated using similar platinum catalyzed hydrogen anodes, silver-oxide cathodes, and two different separator systems, Pellon/PKT and Dynel/cellophane/Pellon, saturated with 30% KOH electrolyte. The charge and discharge performance capabilities of the two types of electrically rechargeable cells have been measured at room temperature at current densities up to 100 milliamperes per square centimeter. The Faradaic and thermodynamic efficiencies and cycle life of the cells have been determined at various charge and discharge rates. Author (GRA)

N77-28613# Arizona Univ., Tucson. Optical Sciences Center.

INVESTIGATION OF HIGH TEMPERATURE PERFORMANCE OF THIN FILM, SOLAR-THERMAL ENERGY CONVERTORS Summary Report, 30 Jun. 1975 - 29 Jun. 1976

Keith D. Masterson and B. O. Seraphin Sep. 1976 36 p
(Grant DI-G-0254032)
(PB-265554/6; BM-OFR-65-77) Avail: NTIS HC A03/MF A01 CSCL 10B

A high temperature reflectometer was used to determine the high temperature performance of selective surfaces. The specular reflectance for nine samples of the absorber-reflector-tandem type with absorber layers of ZrC(x)N(y) was obtained for temperatures up to 700C in some cases. A diffuse reflectometer of the integrating sphere type was used to characterize several samples that used fine grain texturing to enhance solar absorption. Specular reflectance measurements for such samples are unreliable because of the large fraction of light that is scattered out of the beam. During the final quarter, stainless steel substrates were coated with chemical vapor deposited molybdenum. Although these sample coatings did not have infrared reflectance as high as expected from previously obtained data, they will be useful for initial stability tests with the Bureau of Mines absorbers. GRA

N77-28614# Bureau of Mines, Denver, Colo. Intermountain Field Operation Center.

PROJECTS TO EXPAND FUEL SOURCES IN WESTERN STATES. SURVEY OF PLANNED OR PROPOSED COAL OIL SHALE, TAR SAND, URANIUM, AND GEOTHERMAL SUPPLY EXPANSION PROJECTS, AND RELATED INFRASTRUCTURE, IN STATES WEST OF THE MISSISSIPPI RIVER (AS OF MAY 1976)

John S. Corsentino Sep. 1976 222 p refs
(PB-265633/8; BM-IC-8719) Avail: NTIS HC A10/MF A01 CSCL 10A

A listing is made of fuels-related projects that are presently under construction, planned, or proposed by various companies and organizations in the Western United States. The future facilities covered fall into the following categories: coal mines and expansions to existing mines, electric powerplants and waste-to-fuel conversion plants, oil shale projects, tar sands projects, potential geothermal facilities, coal slurry pipelines, railroads related to fuels development, uranium mines and enrichment facilities, oil refineries, and natural gas processing plants. GRA

N77-28615# Federal Energy Administration, Washington, D. C. Office of Finance and Environment.

FEA ENERGY FINANCING WORKSHOPS. SECTION 1: SUMMARIES OF PROCEEDINGS. SECTION 2: BACK-

GROUND PAPERS
Jan. 1977 701 p refs
(PB-265706/2; FEA/G-77/011) Avail: NTIS HC A99/MF A01 CSCL 10A

During 1976, the Federal Energy Administration sponsored a series of workshops on the financing of different energy sources. The workshops are: (1) Eastern Coal; (2) Western Coal; (3) Socioeconomic Impacts of Western Energy Development; (4) Electric Utilities; (5) Supplemental Gas Projects. This combined collection of Summaries and workshop background papers provides a significant compilation of background and views concerning several of the most important energy finance issues currently facing the Nation. GRA

N77-28616# Federal Energy Administration, Washington, D. C. Office of Policy, Program Development and Environment.
QUARTERLY REPORT TO US HOUSE AND SENATE COMMITTEES ON APPROPRIATIONS (3RD) Quarterly Report, Jun. - Sep. 1976
Jan. 1977 40 p refs
(PB-265490/3; FEA/D-77/027; QR-3) Avail: NTIS HC A03/MF A01 CSCL 10A

The process of the Federal Energy Administration's (FEA) energy conservation programs and short- and long-term accomplishments are reported to the House and Senate Committees on Appropriations. GRA

N77-28617# Simulation Physics, Inc., Bedford, Mass.
SILICON THIN FILM CRYSTALLIZATION AND SOLAR CELL FABRICATION Quarterly Progress Report, Oct. - Dec. 1976
A. R. Kirkpatrick, T. P. Shaughnessy, and M. Oren Feb. 1977 59 p
(Grant NSF AER-76-06096)
(PB-266072/8; QR-10045-3; NSF/RA-770039; QPR-3) Avail: NTIS HC A04/MF A01 CSCL 10B

A process is developed for fabricating high efficiency solar cells from thin silicon films using novel techniques of electrostatic bonding for film transfer, ion implantation for junction formation, and pulsed electron beams for high temperature processing. Also, thin silicon films are crystallized using directed energy sources. Considerable effort is expended in junction formation and grain boundary treatments. Mesa diode structures are used to evaluate a wide range of processing parameters. The most significant item of progress is the fabrication of mesa diode solar cell structures using ion implantation and pulse annealing for junction formation. GRA

N77-28618# Southern Methodist Univ., Dallas, Tex.
DEVELOPMENT OF LOW COST THIN FILM POLYCRYSTALLINE SILICON SOLAR CELLS FOR TERRESTRIAL APPLICATIONS Final Report, 1 Jun. 1973 - 30 Nov. 1976
Ting L. Chu Jan. 1977 107 p refs
(Grant NSF AER-73-07843)
(PB-266057/9) Avail: NTIS HC A06/MF A01 CSCL 10B

The purification of metallurgical silicon has been investigated in detail. Using chemically treated metallurgical silicon recrystallized on graphite as a substrate, epitaxial silicon films and solar cell structures have been depositied and characterized. Large area (30 sq cm) cells have AM1 efficiencies of up to 5.5%, and small area (5 sq cm) cells have AM1 efficiencies higher than 6%. GRA

N77-28619# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Measurement of Energy Consumption.
ENERGY CONSUMPTION MEASUREMENT: DATA NEEDS FOR PUBLIC POLICY
1977 120 p refs
(Contract FEA-CO-03-50343-00)
(PB-266039/7; FEA/B-77/159) Avail: NTIS HC A06/MF A01 CSCL 10A

The need for improved data on energy consumption and some general methods of collecting and organizing data for use in designing and evaluating public policy are analysed. GRA

N77-28620# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EXPLORATION OF MOLECULAR SIEVE ZEOLITES FOR THE COOLING OF BUILDING WITH SOLAR ENERGY Final Report, 1 Sep. 1974 - 31 Aug. 1975
D. I. Tchernev 1 Feb. 1977 99 p
(Grant NSF AER-74-09038)
(PB-266055/3; NSF/RA-770017) Avail: NTIS HC A05/MF A01 CSCL 13A

The usefulness of molecular sieve zeolites for solar sorption heating and cooling has been investigated. Two different approaches have been used, one in which the temperature of the zeolite is uniform, the other in which a temperature gradient is established across the zeolite. With one-square-foot test panels using the uniform temperature approach, overall engineering efficiencies as high as 75% for heating with a condenser temperature of 60C (140F) were obtained. Cooling efficiencies as high as 45% were obtained for a condenser temperature of 50C (120F), the maximum temperature expected for an air-cooled condenser. GRA

N77-28621# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
THERMAL IMAGERY FOR EVALUATION OF CONSTRUCTION AND INSULATION CONDITIONS OF SMALL BUILDINGS Final Report, Jul. 1975 - May 1976
Fred J. Tanis, Robert E. Sampson, and Thomas W. Wagner Jul. 1976 103 p
(Contract FEA-CO-04-50233-00)
(PB-265484/6; ERIM-116600-12-F; FEA/D-77/119) Avail: NTIS HC A06/MF A01 CSCL 13M

Airborne and ground infrared imaging techniques to gain information on heat loss from buildings are discussed. A portable infrared device has been used to examine the interior and exterior of residences. Example thermograms presented show the kind of construction defects and insulation problems which can be analyzed from ground surveys. Aerial survey imagery is shown and analyzed with residential questionnaire results. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N77-28622*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA GLOBAL ATMOSPHERIC SAMPLING PROGRAM (GASP) DATA REPORT FOR TAPE VL0006
Daniel J. Gauntner, J. D. Holdman, and Francis M. Humenik Jul. 1977 43 p refs
(NASA-TM-73727; E-9284) Avail: NTIS HC A03/MF A01 CSCL 13B

The NASA Global Atmospheric Sampling Program (GASP) is obtaining measurements of atmospheric trace constituents in the upper troposphere and lower stratosphere using fully automated air sampling systems on board several commercial B-747 aircraft in routine airline service. Atmospheric ozone, and related flight and meteorological data were obtained during 245 flights of a Qantas Airways of Australia B-747 and two Pan American World Airways B-747s from July 1976 through September 1976. In addition, whole air samples, obtained during three flights, were analyzed for trichlorofluoromethane, and filter samples, obtained during four flights, were analyzed for sulfates, nitrates, fluorides, and chlorides. Flight routes and dates, instrumentation, data processing procedures, data tape specifications, and selected analyses are discussed. Author

N77-28623*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INSTRUMENTATION OF SAMPLING AIRCRAFT FOR MEASUREMENT OF LAUNCH VEHICLE EFFLUENTS
Dewey E. Wornom, David C. Woods, Mitchel E. Thomas, and Richard W. Tyson Washington Jul. 1977 41 p refs
(NASA-TM-X-3500; L-11198) Avail: NTIS HC A03/MF A01 CSCL 13B

An aircraft was selected and instrumented to measure effluents emitted from large solid propellant rockets during launch activities. The considerations involved in aircraft selection, sampling probes, and instrumentation are discussed with

respect to obtaining valid airborne measurements. Discussions of the data acquisition system used, the instrument power system, and operational sampling procedures are included. Representative measurements obtained from an actual rocket launch monitoring activity are also presented. Author

N77-28624# Electric Power Research Inst., Palo Alto, Calif.
EPRI: REGIONAL SEMINARS ON THE ENVIRONMENTAL CONTROL AND COMBUSTION PROGRAM
K. Yeager, G. J. Lanzolatta, and F. E. Gartell Aug. 1976 151 p
(EPRI-FP-295-SR) Avail: NTIS HC A08/MF A01

Recommendations were provided by the utilities for increased R and D emphasis on problems affecting the near-term operation of existing and planned power generating capacity. Their recommendations focused on improved water quality control technology and improved performance and reliability of combustion as well as environmental control equipment. These recommendations recognized the pressures faced by the utility industry in meeting increasingly stringent performance requirements with generally diminishing fuel quality. ERA

N77-28625# Radian Corp., Austin, Tex.
EXPERIMENTAL AND THEORETICAL STUDIES OF SOLID SOLUTION FORMATION IN LIME AND LIMESTONE SO2 SCRUBBERS, VOLUME 1 Final Report
Benjamin F. Jones, Philip S. Lowell, and Frank B. Meserole Oct. 1976 75 p refs
(Contract EPA-68-02-1883)
(PB-264953/1; EPA-600/2-76-273a-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 07D

A coprecipitation product has been suggested to explain the mechanism by which sulfate could be precipitated from a scrubber solution subsaturated with respect to calcium sulfate. The existence of a calcium sulfate/calcium sulfite solid solution has been confirmed experimentally and a theoretical formulation has been established. Calcium sulfite hemihydrate was precipitated under controlled laboratory conditions from solutions subsaturated in calcium sulfate. Specific chemical analysis and infrared spectroscopic techniques were used to identify sulfate in the solids. GRA

N77-28626# Radian Corp., Austin, Tex.
EXPERIMENTAL AND THEORETICAL STUDIES OF SOLID SOLUTION FORMATION IN LIME AND LIMESTONE SO2 SCRUBBERS. VOLUME 2: APPENDICES
Benjamin F. Jones, Philip S. Lowell, and Frank B. Meserole Oct. 1976 417 p refs
(Contract EPA-68-02-1883)
(PB-264954/9; EPA-600/2-76-273b-Vol-2-App) Avail: NTIS HC A18/MF A01 CSCL 07D

Limestone scrubbing procedures are described, the following subjects are studied: (1) thermodynamics of the solid solution series (CaSO3/CaSO4) .1/2H2O; (2) a review of plant and pilot plant data relating to the formation of solid solution series; (3) experimental equipment and sampling techniques utilized in the experimental studies of solid solution formation; (4) analytical techniques utilized in the experimental studies of solid solution formation; (5) analytical results, reactor material balances, and computer equilibrium data of laboratory experimental runs; (6) infrared spectra of precipitated solids from laboratory and pilot plant studies; (7) differential scanning calorimetry patterns of precipitated solids. GRA

N77-28627# Environmental Sciences Research Lab., Research Triangle Park, N.C.
PROCEEDINGS OF 1975 SYMPOSIUM ON NORTHEAST OXIDANT TRANSPORT STUDY (1975) Final Report
Joseph J. Bufalini and William A. Lonneman Feb. 1977 146 p Symp. held at Research Triangle Park, North Carolina, 20-21 Jan. 1976
(PB-265370/7; EPA-600/3-77-017) Avail: NTIS HC A07/MF A01 CSCL 04A

Preliminary results of ozone measurements collected during a study conducted to investigate transport phenomena in the Northeastern United States are discussed. The extent and importance of transport in this densely populated area are also discussed. The necessary information needed to determine the suitability of present control strategy is provided. GRA

N77-28628# Systems Applications, Inc., San Rafael, Calif.
THE CHEMISTRY, DISPERSION, AND TRANSPORT OF AIR POLLUTANTS EMITTED FROM FOSSIL FUEL POWER PLANTS IN CALIFORNIA: DATA ANALYSIS AND EMISSION IMPACT MODEL Final Report
Mei-Kao Liu, Dale Durran, Pravin Mundkur, Mark Yocke, and Jody Ames 15 Sep. 1976 336 p refs
(Contract ARB-4-258)
(PB-264822/8; EF76-18R; ARB-R-4-258-76-54) Avail: NTIS HC A15/MF A01 CSCL 04A

Mathematical models developed to study the effects on air quality of using high-sulfur fuels in power plants are described. The Reactive Plume Model (RPF), adopting a trajectory approach, accommodates variations in wind speed, plume spread, and ambient concentrations. The Buoyant Plume Model (BPM) predicts plume rise and effluent dispersion near the stack. It invokes the Navier-Stokes equation with the Boussinesq approximation, and allows for plume-generated turbulent diffusion. The Plume Dispersion Model (PDM) simulates pollutant distributions far downwind, PDM solves the three-dimensional atmospheric diffusion equation, and incorporates variations in wind speeds. GRA

N77-28629# Midwest Research Inst., Minneapolis, Minn.
NEW MEMBRANES FOR TREATING METAL FINISHING EFFLUENTS BY REVERSE OSMOSIS Final Report
Robert J. Petersen and Kenneth E. Cobian Oct. 1976 71 p refs
(Grant EPA-R-803264)
(PB-265363/2; EPA-600/2-76-197) Avail: NTIS HC A04/MF A01 CSCL 07A

Long-term reverse osmosis tests were conducted with electroplating wastes on a new membrane referred to as NS-100. This membrane consists of a polyurea layer, formed by the reaction of tolylene diisocyanate with polyethylenimine, deposited on a porous polysulfone support film. The membranes were tested as liners within 1/2-inch diameter fiber glass tubes. A total of 2360 hours of continuous reverse osmosis operation was achieved, 1220 hours on pH 1.2 acid copper rinse water and 1140 hours on pH 12.8 alkaline zinc cyanide rinse water. The membranes exhibited remarkable chemical stability during exposure to these two pH extremes. Copper and zinc rejections were generally greater than 99 percent, while cyanide rejections were typically 96 percent or greater. GRA

N77-28630# Air Force Civil Engineering Center, Tyndall AFB, Fla.
THE EFFECT OF NAVY AND AIR FORCE AIRCRAFT ENGINE TEST FACILITIES ON AMBIENT AIR QUALITY Final Report, 1 Jun. 1975 - 31 Jul. 1976
Bradford C. Grems, III and Dennis F. Naugle 8 Oct. 1976 26 p Supersedes AFCEC-TM-76-7
(AD-A036393; AFCEC-TR-76-36; AFCEC-TM-76-7) Avail: NTIS HC A03/MF A01 CSCL 21/5

An investigation of the air quality impact of DoD turbine engine test facilities was performed. Emissions and pollutant dispersion from test cells and aircraft at six DoD installations were predicted using a sophisticated computer model. Predicted pollutant concentrations are compared to ambient air quality standards and measured ambient values for hydrocarbons, oxides of nitrogen, and particulates. Jet engine test cells have no significant impact on air quality for any pollutant at any location studied. Test cell pollutant concentrations are considerable less than the levels generated by aircraft operations and well below measured ambient air quality levels in the areas studied. Ambient carbon monoxide and sulfur dioxide levels resulting from test cell emissions are insignificant. Control of any pollutants generated by test cells would not measurably improve ambient air quality. Author (GRA)

N77-28631# California Univ., Riverside. Statewide Air Pollution Research Center.
MECHANISMS OF PHOTOCHEMICAL REACTIONS IN URBAN AIR. VOLUME 1: CHEMISTRY STUDIES Final Report, 1 Dec. 1971 - 1 Dec. 1974

James N. Pitts Feb. 1977 184 p refs
(Grant EPA-R-800649)
(PB-265592/6; EPA-600/3-77-014a) Avail: NTIS HC A09/MF A01 CSCL 07E

Results are presented of a research program concerned with selected aspects of the kinetics, mechanisms and products of reactions involved in photochemical air pollution. Rate constants were determined, using competitive and modulation-phase shift techniques for the gas phase reaction of O(triplet P) atoms with a variety of organic and inorganic species over the temperature range 296-423K. Products for the gas phase reaction of O(triplet P) atoms with toluene and 1-methylcyclohexene were also studied. The products and mechanisms of the reaction of nitric oxide with methyl peroxy radicals were investigated at 296K using long path infrared spectroscopic and gas chromatographic techniques. GRA

N77-28632# California Univ., Riverside. Statewide Air Pollution Research Center.

MECHANISMS OF PHOTOCHEMICAL REACTIONS IN URBAN AIR. VOLUME 2: CHAMBER STUDIES Final Report, 1 Dec. 1971 - 1 Dec. 1974

James N. Pitts, Karen R. Darnall, Arthur M. Winer, and John M. McAfee Feb. 1977 255 p refs
(Grant EPA-R-800649)
(PB-265593/4; EPA-600/3-77-014b) Avail: NTIS HC A12/MF A01 CSCL 07E

The smog chamber facility has been employed in a study designed to provide experimental data required for the validation of kinetic computer models of chemical transformations in polluted atmospheres. A 5800-l, Teflon-coated, evacuable chamber and 25-KW xenon arc solar simulator were used for irradiations, under simulated atmospheric conditions, of hydrocarbon-NOx systems. Detailed time-concentration profiles were obtained for a wide range of products as well as the reactants employed. Relative and absolute concentrations of the hydrocarbon-NOx systems were chosen on a factorial design basis. GRA

N77-28633# Environmental Protection Agency, Chicago, Ill. Office of Great Lakes Coordinator.

BEST MANAGEMENT PRACTICES FOR NON-POINT SOURCE POLLUTION CONTROL SEMINAR. (GUIDANCE FOR SECTION 208 PLANNERS AND IMPLEMENTING AGENCIES)

Ralph G. Christensen and Carl D. Wilson Dec. 1976 341 p refs Proc. held at Rosemont, Ill., 16-17 Nov. 1976
(Grants EPA-G-005103; EPA-G-005140; EPA-G-005139; EPA-Y-005141)
(PB-265731/0; EPA-905/9-76-005) Avail: NTIS HC A15/MF A01 CSCL 13B

A collection of technical papers was presented at the 'Best Management Practices for Non-point Source Pollution Control' Seminar held in Rosemont Illinois, on November 16 and 17, 1976. The principal investigators of four Section 108(a) demonstration projects present their data and interpretation thereof, that has been collected on their respective projects through September of 1976. These projects include sediment/erosion control, land management, and urban runoff activities. Federal, State and County officials give their agency views on Section 208 planning. GRA

N77-28634# PEDCO-Environmental Specialists, Inc., Cincinnati, Ohio.

COLORADO AQMA AREA SOURCE EMISSION INVENTORY Final Report

Nov. 1975 130 p refs
(Contract EPA-68-02-1375)
(PB-265735/1; EPA-908/1-76-003) Avail: NTIS HC A07/MF A01 CSCL 13B

Emission estimates for non point sources of air pollution in AQMA counties of the State of Colorado are presented. Estimates for particulate, carbon monoxide, sulfur oxides, hydrocarbons and oxides of nitrogen emissions are made for the base year (present), 1980 and 1985. Methodologies and data sources are presented. GRA

N77-28635# Purdue Univ., Lafayette, Ind.

PROCEEDINGS OF THE CONFERENCE ON NONPOINT SOURCES OF WATER POLLUTION: PROBLEMS, POLICIES, AND PROSPECTS

Harry R. Potter Sep. 1976 167 p refs Conf. held at Purdue Univ., 13-14 Sep. 1976
(PB-265665/0) Avail: NTIS HC A08/MF A01 CSCL 13B

There were 13 papers presented in the areas of precipitation, urban runoff, highways, agriculture, forests, and mining. Also included was an overview of policies and programs, and a panel discussion on problems, prospects, and practicalities. GRA

N77-28636# National Academy of Sciences - National Research Council, Washington, D. C.

ANALYTICAL STUDIES FOR THE US ENVIRONMENTAL PROTECTION AGENCY. VOLUME 1: PERSPECTIVES ON TECHNICAL INFORMATION FOR ENVIRONMENTAL PROTECTION

1977 119 p
(PB-266025/6) Avail: NTIS HC A06/MF A01 CSCL 13B

The acquisition and use of scientific information necessary to establish U.S. environmental regulatory policies are reported. Involved are decision making, research management, monitoring, and manpower utilization and staffing. Of particular concern are the costs of pollution abatement activities, long term effects on environmental regulations on the energy crisis, effect of emission control standards on the cost and performance of automobiles, and the benefits and hazards to humans of pesticides, along with the effects of banning certain chemicals. GRA

N77-28637# Research Triangle Inst., Research Triangle Park, N. C.

PROCEEDINGS: SEMINAR ON IN-STACK PARTICLE SIZING FOR PARTICULATE CONTROL DEVICE EVALUATION Technical Report, Dec. 1975 - Sep. 1976

Douglas VanOsdell Feb. 1977 346 p refs Seminar held at Research Triangle Park, N. C., 3-4 Dec. 1975
(Contract EPA-68-01-1788)
(PB-266103/1; EPA-600/2-77-060) Avail: NTIS HC A15/MF A01 CSCL 13B

Cascade impactors, including calibration, field use experience, weighing techniques, and elemental analysis of impactor samples are discussed. Sizing techniques other than with cascade impactors were considered with special emphasis on diffusion batteries. The proceedings consist of edited versions of the seminar speakers' transcripts. Some were edited into technical paper format; others remain in conversational tone. GRA

N77-28638# Aerospace Corp., El Segundo, Calif. Environment and Energy Conservation Div.

INVENTORY OF COMBUSTION-RELATED EMISSIONS FROM STATIONARY SOURCES (FIRST UPDATE) Report for Jul. 1974 - Jul. 1976

Owen W. Dykema and Vernon E. Kemp Mar. 1977 354 p refs
(Grant EPA-R-803283-02)
(PB-266109/8; ATR-76(7549)-1-REV-B; EPA-600/2-77-066a) Avail: NTIS HC A16/MF A01 CSCL 13B

The inventory includes emissions of oxides of nitrogen, hydrocarbons, carbon monoxide, and particulate matter, not only from stationary sources primarily involving combustion, but also from other stationary sources where combustion plays a secondary role. Approximately 68% of particulate matter and between 93% and 97% of NOx, hydrocarbon, and carbon monoxide emissions are identified from stationary sources. GRA

N77-28639# West Virginia Univ., Morgantown. Dept. of Chemical Engineering.

ANALYSIS AND SIMULATION OF RECYCLE SO2-LIME SLURRY IN TCA (TURBULENT CONTACT ABSORBER) SCRUBBER SYSTEM Final Report, Jun. 1974 - Aug. 1976

C. Y. Wen and Fred K. Fong Mar. 1977 121 p refs
(Grant EPA-R-800781-03-0)
(PB-266104/9; EPA-600/7-77-026) Avail: NTIS HC A06/MF A01 CSCL 07A

The analysis of CO2 absorption indicates that the overall mass transfer coefficient is a function of the pH of inlet and outlet scrubber liquor and is very sensitive to the liquor flow rate. The correlations developed are used to formulate a simulation procedure for predicting SO2 scrubbing efficiency as a function

of pH of slurry and gas and liquor flow rates. The result of simulation indicates that, for a given lime feed rate and a fixed inlet and outlet SO2 concentration, a maximum flue gas flow rate exists which the scrubber can treat by the recycling slurry.
Author

N77-28640# Illinois Univ., Urbana-Champaign. Charged Particle Research Lab.
ELECTRIC CURTAIN DEVICE FOR CONTROL AND REMOVAL OF FINE PARTICLES Final Report, May 1975 - Oct. 1976
A. Yen, R. J. Turnbull, and C. D. Hendricks Feb. 1977 31 p refs
(Grant EPA-R-8-3047)
(PB-266094/2; EPA-600/2-77-055) Avail: NTIS HC A03/MF A01 CSCL 07A

An electric curtain for particulate control and removal is evaluated. If the particles are charged by corona, the curtain stops them only in a very slow air flow (less than 2 cm/sec). At these slow flows, a vertical curtain stops the particles and a 45-degree curtain moves them along the curtain without penetrating it. A horizontal electric curtain was used to suspend the particles against gravity. Finally, an attempt to use highly charged water drops as the particle collection mechanism was unsuccessful because of electrical breakdown caused by the water. GRA

N77-28641# Aerospace Corp., Los Angeles, Calif.
HETEROGENEOUS REACTIONS OF NITROGEN OXIDES IN SIMULATED ATMOSPHERES Interim Report, Nov. 1973 - Nov. 1976
H. S. Judeikis, S. Siegel, T. B. Stewart, and H. R. Hedgpeth Mar. 1977 34 p refs
(Grant EPA-R-802687)
(PB-266127/0; ATR-75(7441)-2; EPA-600/3-77-028) Avail: NTIS HC A03/MF A01 CSCL 14B

Heterogeneous reactions of nitrogen dioxide and nitric oxide were examined to evaluate their potential role in reaction in polluted urban atmosphere. The results suggest that nitrogen dioxide decomposes on a wide variety of solids likely to be found in urban environments. Measured reaction rates indicate these processes can be important in the atmosphere. Humidification of reaction mixtures leads to increased reactivities. It is concluded that heterogeneous reactions in the atmosphere are unimportant for the oxidation of nitric oxide. GRA

N77-28642# Aerotherm Acurex Corp., Mountain View, Calif.
EVALUATION OF MOLTEN SCRUBBING FOR FINE PARTICULATE CONTROL Final Report, Dec. 1975 - Feb. 1976
G. G. Poe, L. R. Waterland, and R. J. Schreiber Mar. 1977 39 p refs
(Contract EPA-68-02-1318)
(PB-266092/6; EPA-600/2-77-067) Avail: NTIS HC A03/MF A01 CSCL 07A

The results of an evaluation of molten scrubbing for particulate control are given. Application of the concept to fine particulate clean-up in advanced energy processes seems possible. Molten scrubbing is especially well-suited to processes where simultaneous removal of sulfur compounds is desired. GRA

N77-28643# Aerotherm Corp., Mountain View, Calif.
EVALUATION OF CERAMIC FILTERS FOR HIGH-TEMPERATURE/HIGH-PRESSURE FINE PARTICULATE CONTROL Final Report, Dec. 1975 - Jun. 1976
G. G. Poe, R. M. Evans, W. S. Bonnett, and L. R. Waterland Feb. 1977 55 p refs
(Contract EPA-68-02-1318)
(PB-266093/4; EPA-600/2-77-056) Avail: NTIS HC A04/MF A01 CSCL 07A

Results of a study to analyze and evaluate ceramic membrane filters as a new, fine particulate (< 3 micrometers) controls concept for high-temperature (approx. 900 C), high-pressure processes. Several ceramic filters were identified as potential candidates for fine particulate removal. There was no inherent material limitation to high-temperature operation; however, no evidence of high-temperature filter application was found. The filters typically are 2-6 mm thick, cylindrical, and available with various pore sizes, increasing upward from 0.5 micrometer. These elements may be suitable for fine particulate control in hot gas streams. The most promising, although undeveloped, idea for a ceramic filter is to use ceramic honeycomb monoliths similar to those available for catalyst supports and heat exchangers. The walls of the monoliths are about 0.2-0.4 mm thick and of varying pore size and porosity. Geometric configurations are available which would force the gas to flow through the membrane walls. Pressure losses would be very small relative to those of standard ceramic filter elements. The application of ceramic monoliths to high-temperature fine particulate control appears very promising. GRA

N77-28644# Mitre Corp., McLean, Va. METREK Div.
EPA AND ERDA HIGH-TEMPERATURE/HIGH-PRESSURE PARTICULATE CONTROL PROGRAMS Final Report
R. A. Kennedy, H. Dhillon, and J. B. Truett Feb. 1977 60 p refs
(Contract EPA-68-01-3539)
(PB-266231/0; EPA-600/7-77-013) Avail: NTIS HC A04/MF A01 CSCL 07A

The report describes and compares current projects sponsored by EPA and the U.S. Energy Research and Development Administration (ERDA), relating to the control of particulate matter in fuel gas streams at high temperatures (1000 to 2000 F) and high pressures (5 atm and greater). The descriptions document each project and provide a narrative statement of objectives and technology involved. Project descriptions provide bases for identifying overlap or duplication, and indicate areas not addressed by either Agency. Comparison of EPA and ERDA activities for possible overlap and omissions is summarized in the conclusions which indicate that there is little evidence of any overlap or duplication. No projects are dedicated exclusively to characterization and study of aerosol mechanics; however, one such EPA-sponsored study was completed recently. Some characterization work is done at ERDA, incident to advanced energy systems development. Development of instrumentation is limited and does not extend to the expected 1000-psig operating range. GRA

N77-28645# Monsanto Research Corp., Dayton, Ohio.
DESIGN OF MINIMUM-WEIGHT DIFFUSION BATTERIES Final Report, Sep. 1973 - Sep. 1974
A. L. Marcum, L. E. Dresher, A. Wojtowicz, and W. H. Hedley Jan. 1977 37 p refs
(Contract EPA-68-02-1320)
(PB-266217/9; MRC-DA-452; EPA-600/2-77-001) Avail: NTIS HC A03/MF A01 CSCL 14B

Particulates in the atmosphere and in the industrial exhaust gases are being monitored extensively in the field. Field work is often seriously hampered by equipment that is heavy or bulky. The diffusion batteries currently in use weigh in excess of fifty pounds and are often the heaviest piece of equipment in a test setup. For this reason, it was felt that the possibility of optimizing the dimensions of the battery for minimum weight should be investigated. The objectives of this study were: first, to analyze the relationship between the physical dimensions of the battery and operational parameters to determine if an optimum configuration exists, and second, to design a series of optimum weight batteries based upon the results of the study. The technical discussion which follows is limited to the first of these objectives. GRA

N77-28646# Comsis Corp., Glastonbury, Conn.
OPEN SPACE AS AN AIR RESOURCE MANAGEMENT MEASURE. VOLUME 3: DEMONSTRATION PLAN (ST. LOUIS, MO.) Final Report
Robert S. DeSanto, Kenneth A. MacGregor, William P. McMillen, and Richard A. Glaser Jan. 1977 151 p refs
(Contract EPA-68-02-2350)
(PB-266450/6; EPA-450/3-76-028c-Vol-3; H800-III) Avail: NTIS HC A08/MF A01 CSCL 13B

Based on the potential use of a hypothetical planting of street trees and idealized forest, an open space program is evaluated for St. Louis within the constraints of real world economics and the environment as it presently exists in that urbanizing area. GRA

N77-28647# Environmental Research Lab., Athens, Ga. Analytical Chemistry Branch.
ENVIRONMENTAL APPLICATIONS OF ADVANCED INSTRUMENTAL ANALYSIS: ASSISTANCE PROJECTS FY 1975
Ann L. Alford Jan. 1977 48 p refs Sponsored by EPA
(PB-266425/8; EPA-600/4-77-004) Avail: NTIS HC A03/MF A01 CSCL 13B

The Analytical Chemistry Branch of the Athens Environmental Research Laboratory identified and measured aquatic pollutants under eight projects in response to requests for assistance from other EPA organizations and other government agencies. In most cases these analyses helped to solve, or at least to understand more clearly, the related pollution incident, and in some cases the analyses provided evidence for enforcement of regulatory legislation. Under an additional project, analytical consultations were held as requested by various organizations concerned with pollution incidents. GRA

N77-28648# Research Triangle Inst., Research Triangle Park, N. C. Operations Analysis Div.
COMPREHENSIVE DATA HANDLING SYSTEM, AIR QUALITY DATA HANDLING SUBSYSTEM (AQDHS-II) PROGRAM DOCUMENTATION AND USER'S GUIDE. SECOND EDITION Final Report
Apr. 1977 454 p
(Contract EPA-68-02-1386)
(PB-266353/2; EPA-450/3-74-045-1) Avail: NTIS HC A20/MF A01 CSCL 13B

The Air Quality Data Handling System (AQDHS-II) provides air pollution control agencies with the capability to create and maintain their own air quality data base and to retrieve data and generate reports from that data base. This report contains documentation for the computer programs which comprise AQDHS-II. It is also written as a Users Guide with each program described, input requirements described, field descriptions, etc. In addition to the basic system, several preprocessor and postprocessor programs are provided which perform functions necessary to make this system compatible with existing systems such as SAROAD and the original AQDHS. The system has a powerful retrieval capability which allows the user to retrieve virtually any piece of data in his file. The system also allows the user to automatically generate his quarterly air quality progress report in SAROAD format. GRA

N77-28649# Olson Labs., Inc., Anaheim, Calif.
EFFECT OF AUTOMOTIVE PARTS ON VEHICLES AND ENGINE EMISSIONS. PHASE 2: AFTER-MARKET PARTS Final Report
Richard R. Carlson May 1977 270 p refs
(Contract EPA-68-01-1957)
(PB-266375/5; EPA-340/2-76-002) Avail: NTIS HC A12/MF A01 CSCL 13F

The methodology and results of Phase II of the Investigation of the Effect of Automotive Parts on Vehicle and Engine Emissions are documented. The primary objective was to identify engine and emission control system components which are critical in causing excessive emissions of one or more regulated pollutants. The emission-criticality of after-market equipment not installed or distributed by the original engine or vehicle manufacturers was investigated. A computer model was developed to calculate and rank-order an index representing the criticality of each component type. Separate rankings were developed for HC, CO, NOx and smoke (heavy-duty diesel engines) emissions using three independent sets of input data. The index for each component type was calculated from the product of four factors representing the emission increase resulting from a component failure, the probability of component repair, and the sales volume of the component. The values of these factors were established based on data obtained from a search of technical literature and engineering analysis of system and component design or operating characteristics. GRA

N77-28650# New Mexico Univ., Albuquerque. Eric H. Wang Civil Engineering Research Facility.
DEVELOPMENT OF CONTOURING CAPABILITY FOR DISPLAYING RESULTS OF AIR QUALITY ASSESSMENT MODEL Final Report, 1 Jul. 1975 - 1 Jun. 1976
Edward P. Dunphy Tyndall AFB, Fla. AFCEC Oct. 1976 41 p refs
(Contract F29601-76-C-0015)
(AD-A036397; CERF-EE-8; AFCEC-TR-76-25) Avail: NTIS HC A03/MF A01 CSCL 09/2

A computer contouring plot package has been developed to display the results of the Air Quality Assessment Model (AQAM). This program accepts input data cards or an input data tape generated on an AQAM run. Up to 20 unequal contour levels with tension parameters and dashline patterns may be specified in each contour plot. The contouring package is written for the CDC 6600 computer system. Author (GRA)

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N77-28651 California Univ., Los Angeles.
THE MAGNETIC EFFECTS OF MAGNETOSPHERIC SUBSTORMS Ph.D. Thesis
Michael Nowlin Caan 1976 179 p
Avail: Univ. Microfilms Order No. 77-1616

An empirical relationship is developed relating the tail lobe magnetic energy density to the solar wind dynamic pressure by using data obtained when the interplanetary field was northward. Localized, off-center, or multiple-onset substorm expansion phases are shown to have little effect on the lobe magnetic field. A positive correlation is found between magnetospherewide substorm expansions and decreases in the lobe energy density. The positive correlation of the energy density with both the solar wind dynamic pressure and a southward interplanetary magnetic field, and the positive correlation between magnetospheric substorm activity and lobe energy density decreases are demonstrated to be consistent with the growth phase model of substorm behavior. Dissert. Abstr.

N77-28652 Catholic Univ. of America, Washington, D. C.
INTERPRETATION OF AEROMAGNETIC ANOMALIES BETWEEN LATITUDES 37 DEG N AND 38 DEG N IN THE EASTERN AND CENTRAL UNITED STATES Ph.D. Thesis
Isidore Zietz 1976 76 p
Avail: Univ. Microfilms Order No. 77-3704

An aeromagnetic map across the eastern and central United States reflects the regional structure and lithology of the magnetic crystalline rocks. The major crustal units that are delineated are the Appalachian Mountain system, the buried southwesterly extension of the Grenville province, the prominent fault zones across Kentucky, southern Illinois, and Missouri, the igneous rocks of the St. Francois Mountains and vicinity, and the buried belt of lowgrade metamorphic rocks in southeastern Kansas. The map also reveals a serious of conspicuous, essentially east-trending magnetic lineaments, anomaly trends, and breaks in anomaly pattern along the entire survey area. Most of these east-trending features coincide in part with Phanerozoic surface faults, deflections in structural pattern, or the presence of intrusive rocks; some of the lineaments have no surface expression.
Dissert. Abstr.

N77-28653 Purdue Univ., Lafayette, Ind.
THE MERCURY-SELENIUM-SULFUR SYSTEM AND ITS GEOLOGICAL IMPLICATIONS. PART 1: PHASE RELATIONS IN THE MERCURY-SELENIUM-SULFUR SYSTEM. PART 2: THE SULFOSELENIDES AND SULFIDES OF MERCURY: MINERALOGY AND GEOCHEMISTRY Ph.D. Thesis
Nabil Zaki Boctor 1976 81 p
Avail: Univ. Microfilms Order No. 77-7418

The phase relations in the portion of the Hg-Se-S system that lies between the S-Se and the HgS-HgSe joins were investigated in the temperature range between 700 C and 200 C by the appearance of phase method and differential thermal analysis. The compositions of coexisting phases were determined by microprobe analysis. A large divariant region exists where

members of the metacinnabar-tiemannite series coexist in equilibrium with S-Se liquid solutions. Microprobe analyses of the sulfoselenides of mercury at the Lucky Boy mine showed that they varied in composition. Investigation of the distribution of Se, Fe, and Zn in metacinnabar from California and Nevada showed that one or more of these elements exist in solid solution in this mineral. Variations in the distribution of impurities in metacinnabar are interpreted as being related to the partial inversion of metacinnabar to cinnabar. Dissert. Abstr.

N77-28654 California Univ., Los Angeles.
APPLICATION OF FLUID-INSTABILITY ANALYSIS TO GLACIER FLOW Ph.D. Thesis
David Edward Thompson 1976 111 p
Avail: Univ. Microfilms Order No. 77-7695

A stability equation is derived for a glacier of uniform thickness flowing without slip down an inclined plane, and effects of the glacier margins are ignored. The stress-dependent viscosity is incorporated into the equations of motion. Two problems are solved. First, an analytic solution to the problem of stability of a fluid, whose viscosity varies exponentially with depth, against long-wavelength surface perturbations provides stability criteria for a wide range of viscosity profiles, one of which approximates the effective viscosity distribution in glaciers. In this simplified model, inertial terms are responsible for instability, so the glacier model appears stable against all infinitesimal-amplitude surface perturbations. Second, the original fully non-Newtonian stability equation is solved numerically, ignoring the small inertial terms on the basis of the results of the first problem. Dissert. Abstr.

N77-28655 Stanford Univ., Calif.
VELOCITY ESTIMATION BY WAVE FRONT SYNTHESIS Ph.D. Thesis
Philip Stephan Schultz 1976 117 p
Avail: Univ. Microfilms Order No. 77-7165

A wave stack is any stack over a common shot or geophone gather in which the move-out is independent of time. It synthesizes a particular wave front by an organized superposition of the many spherical wave fronts of raw data. Unlike the common midpoint stack, wave stacks retain the important property of being the sampling of a real possible wave field, and as such permit rigorous wave equation treatment of formerly difficult or impossible problems. Seismic sections generated by wave stacks which synthesize slanted downgoing plane waves of a fixed ray parameter show a similarity in appearance to the common midpoint stacks. In signal to noise ratio they lie between the single offset section and the midpoint stack. A velocity dependent coordinate transormation in these slant frames effects the same first order dip correction as common midpoint coordinates on raw data. Dissert. Abstr.

N77-28656 South Carolina Univ., Columbia.
UPPER MESOZOIC MAGNETOSTRATIGRAPHY Ph.D. Thesis
Thomas J. Schmitt 1976 65 p
Avail: Univ. Microfilms Order No. 77-6780

The upper Mesozoic polarity history of the Earth's magnetic field as derived from the marine magnetic anomalies, radiometrically dated paleomagnetic sites, and a sequence of biostratigraphically dated marine carbonates from Tunisia were compared. The radiometric survey served to date major changes in field behavior. The gross field behavior determined by that survey was used as a check on the reliability of the carbonate study. The magtostratigraphy of the carbonates established biostratigraphic ages for the anomalies and determined the fine scale history of the field lost from the marine magnetic anomalies due to attenuation.
Dissert. Abstr.

N77-28657 Cornell Univ., Ithaca, N.Y.
INELASTIC DEFORMATION OF LITHOSPHERES WITH TERRESTRIAL AND MARTIAN APPLICATIONS Ph.D. Thesis
David Crane McAdoo 1976 186 p
Avail: Univ. Microfilms Order No. 77-8397

Specific models of an inelastic lithosphere are developed, particular applications are considered, and a range of potential problems are described. Although the focus is primarily on the development of time independent or plasticity models, time dependent or creep models are examined. Models of an elastic-plastic lithosphere (i.e., time independent inelastic) are developed and considered as a limiting case on time dependent representations. Plasticity techniques are used to derive the response of an elastic-plastic lithosphere to a line/strip loading. The concept of an elastic-plastic lithosphere is also applied to Mars. Dissert. Abstr.

N77-28658 Stanford Univ., Calif.
THERMAL AND MECHANICAL STUDIES OF THE EARTH'S LITHOSPHERE AND ASTHENOSPHERE Ph.D. Thesis
Sherman Thomas Crough 1976 153 p
Avail: Univ. Microfilms Order No. 77-7071

An approximate solution of the boundary-layer cooling problem is developed for the case where the asthenosphere has a heat flux through it. Reasonable results are obtained assuming an asthenospheric heat flux of 0.6 to 0.8 HFU. No large amount of melting in the asthenosphere is needed. The heat flux beneath oceanic lithosphere assumed in this model has the same value as that inferred from observed data to exist beneath continental lithosphere. Using this value, the oldest ocean basins are predicted to still be in the process of cooling off. This explains why oceanic heat flow is observed to be higher than predicted by most steady-state models. The experimental deformation of peridotite indicates that the flow law in the asthenosphere is likely to be that deviatoric stress equals strain-rate to the one-third power times a proportionality constant C. A finite-difference solution is calculated for an idealized case of isostatic rebound above an asthenosphere with this flow law. Dissert. Abstr.

N77-28659 Cornell Univ., New York.
1. UPPER MANTLE STRUCTURE BENEATH THE FIJI PLATEAU: SEISMIC OBSERVATIONS OF SECOND P-ARRIVALS FROM THE OLIVINE SPINEL PHASE TRANSITION ZONE. 2: STRAINMETER AND TILTMETER MEASUREMENTS FROM THE TONGA ISLAND ARC. 3: THE CASE FOR FOUR-COMPONENT STRAINMETERS Ph.D. Thesis
Clifford Arnold Frohlich 1976 166 p
Avail: Univ. Microfilms Order No. 77-8423

Large and impulsive second P-arrivals (4-12 second after the intial P-arrivals) from intermediate depth earthquakes located in the New Hebrides island arc are observed at distances of 7 deg. to 14 deg. on the records produced by short-period seismographs in Fiji. This conclusion is consistent with: (1) the observed onset distance of the travel time cusp, (2) the change with distance of Delta t (the time difference between the first and second P-arrivals), (3) the change of Delta t with the depth of the events, (4) the slowness of the first and second P-arrivals, and finally, (5) comparisons with the predicted arrival times from other published velocity models which contain a rapid P-velocity increase in the upper mantle. A four-component quartz tube strainmeter with capacitance transducers was installed in a surface site on the small coral island of Tongatapu in Tonga and 30 days of data was analyzed. Semidiurnal lunar tidal strains with peak-to-peak amplitudes were observed on all components.
Dissert. Abstr.

N77-28660 Columbia Univ., New York.
FULL WAVE THEORY APPLIED TO A DISCONTINUOUS VELOCITY INCREASE: THE INNER CORE BOUNDARY Ph.D. Thesis
Vernon Francis Cormier 1976 133 p
Avail: Univ. Microfilms Order No. 77-8249

A full wave theory was applied to the calculation of theoretical seismograms for PKP interacting with the discontinuous velocity increase at the inner core - outer core boundary. A complex velocity profile accounts for attenuation and the uniformly asymptotic method Langer (1949) accounts for the frequency dependence of reflection-transmission coefficients near grazing incidence. The problem encountered at critical incidence was the use of the Debye ray expansion. A correct evaluation was obtained of all the waves in the high velocity medium that are repeatedly refracted back up to, and reflected from the low velocity medium. A conclusion from the calculations of PKP near the D cusp is that the transition from the region of partial to total reflection near critical incidence was smooth and uncomplicated at finite frequency and spread out over a wider distance range

surrounding the critical point as the frequency of the wave decreases. Dissert. Abstr.

N77-28661 Arizona Univ., Tucson.
THE ANALYSIS OF THE GRAVITY ANOMALIES OF ARIZONA Ph.D. Thesis
Carlos Lynn Virgil Aiken 1976 162 p
Avail: Univ. Microfilms Order No. 77-2313

A residual Bouguer gravity anomaly map was constructed for the state in which a trend surface of the elevation is used as the reduction datum in the Bouguer correction. Elevation values from topographic maps and not gravity station elevations were used to prepare the regional elevation datum because station elevations do not adequately sample the range in elevations. Small- and large-wavelength residual Bouguer gravity anomalies and trends of anomalies are brought out more clearly by the residual Bouguer gravity anomaly map than by previous gravity maps. The most prominent features in the residual anomalies are a strong gravity gradient 50 km wide striking west-northwest across southern Arizona and a large wavelength residual Bouguer gravity anomaly low in the Coconino Plateau of northwest Arizona. Dissert. Abstr.

N77-28662*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
REVISED ESTIMATION OF 550-km TIMES 550-km MEAN GRAVITY ANOMALIES
M. R. Williamson 7 Apr. 1977 27 p refs
(Grant NGR-09-015-002)
(NASA-CR-154101; SAO-SR-377) Avail: NTIS HC A03/MF A01 CSCL 08N

The calculation of 550-km x 550-km mean gravity anomalies from 1 degree x 1 degree mean free-air gravimetry data is discussed. The block estimate procedure developed by Kaula is used to obtain 1,504 of the 1,654 possible mean block anomalies. The estimated block anomalies calculated from 1 deg x 1 deg mean anomalies referred to the reference ellipsoid and from 1 degree x 1 degree mean anomalies referred to a 24th-degree-and-order field are compared. Author

N77-28663*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INTERNATIONAL CONFERENCE ON PROBLEMS RELATED TO THE STRATOSPHERE
W. Huntress, Jr. 15 May 1977 273 p refs Conf. Proc. held at Logan, Utah, 15-17 Sep. 1976
(Contract NAS7-100)
(NASA-CR-154106; JPL-Publ-77-12) Avail: NTIS HC A12/MF A01 CSCL 04A

The conference focused on four main areas of investigation: laboratory studies and stratospheric chemistry and constituents, sources for and chemical budget of stratospheric halogen compounds, sources for and chemical budget of stratospheric nitrous oxide, and the dynamics of decision making on regulation of potential pollutants of the stratosphere. Abstracts of the scientific sessions of the conference as well as complete transcriptions of the panel discussions on sources for an atmospheric budget of holocarbons and nitrous oxide are included. The political, social and economic issues involving regulation of potential stratospheric pollutants were examined extensively. Author

N77-28664*# Maryland Univ., College Park. Dept. of Electrical Engineering.
ESTIMATED PROBABILITY DENSITY FUNCTIONS FOR THE TIMES BETWEEN FLASHES IN THE STORMS OF 12 SEPTEMBER 1975, 26 AUGUST 1975, AND 13 JULY 1976
S. A. Tretter 17 Aug. 1977 35 p
(Grant NsG-5048)
(NASA-CR-154126) Avail: NTIS HC A03/MF A01 CSCL 04A

A report is given to supplement the progress report of June 17, 1977. In that progress report gamma, lognormal, and Rayleigh probability density functions were fitted to the times between lightning flashes in the storms of 9/12/75, 8/26/75, and 7/13/76 by the maximum likelihood method. The goodness of fit is checked by the Kolmogoroff-Smirnoff test. Plots of the estimated densities along with normalized histograms are included to provide a visual check on the goodness of fit. The lognormal densities are the most peaked and have the highest tails. This results in the best fit to the normalized histogram in most cases. The Rayleigh densities have too broad and rounded peaks to give good fits. In addition, they have the lowest tails. The gamma densities fall inbetween and give the best fit in a few cases. Author

N77-28665*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
DENSITIES AND TEMPERATURES IN THE POLAR THERMOSPHERE
Larry J. Gardner 30 Jun. 1977 155 p refs
(Grant NGL-39-009-003)
(NASA-CR-153932; PSU-IRL-SCI-455) Avail: NTIS HC A08/MF A01 CSCL 04A

The atomic oxygen density at 120 km, the 630 nm airglow temperature, the helium density at 300 km and the molecular nitrogen density near 400 km were examined as functions of geomagnetic latitude, geomagnetic time, season and magnetic activity level. The long-term averages of these quantities were examined so as to provide a baseline of these thermospheric parameters from which future studies may be made for comparison. The hours around magnetic noon are characterized by low temperatures, high O and He densities, and median nitrogen densities. The pre-midnight hours exhibit high temperatures, high He density, low nitrogen density and median O densities. The post-midnight sector shows low O and He densities, median temperatures and high nitrogen densities. These results are compared to recent models and observations and are discussed with respect to their causes due to divergence of the wind field and energy deposition in the thermosphere. Author

N77-28666# Battelle Pacific Northwest Labs., Richland, Wash.
CRITICAL REVIEW OF HYDRAULIC MODELING ON ATMOSPHERIC HEAT DISSIPATION
Yasuo Onishi and Stuart M. Brown Jan. 1977 49 p refs
(Contract EY-76-C-06-1830)
(BNWL-2166) Avail: NTIS HC A03/MF A01

The useful roles of hydraulic modeling in understanding the predicting atmospheric effects of heat dissipation systems; the state-of-the-art of hydraulic modeling of atmospheric phenomena; potentially useful existing hydraulic modeling facilities both in the United States and abroad; and hydraulic model studies to assist the assessment of atmospheric effects of nuclear energy centers, are described. ERA

N77-28667# Panametrics, Inc., Waltham, Mass.
ANALYSIS OF GROUND STATION MAGNETOMETER DATA OBTAINED DURING THE ROCKET LAUNCHES IN THE AEOLUS PROGRAM, APRIL 1975, AT FORT CHURCHILL, MANITOBA Final Report, Dec. 1975 - Dec. 1976
Frederick A. Hanser and Bach Sellers Dec. 1976 73 p refs
(Contract F19628-76-C-0121)
(AD-A038807; AFGL-TR-77-0043) Avail: NTIS HC A04/MF A01 CSCL 20/3

Magnetometer data from more than a dozen ground stations near the Ft. Churchill part of the Auroral Zone have been obtained and analyzed for the AEOLUS rocket launches in April 1975. The magnetically active launch of 10 April showed considerable activity starting to the west of, and moving into, the Ft. Churchill area. The quiet launch of 21 April showed little activity. The Auroral launch of 25 April was accompanied by magnetic activity, though not as intense as that of 10 April. Electrojet calculations show that conditions on 10 April were very promising for high altitude wave generation that might be observable in the chemical release data. Author (GRA)

N77-28668# Air Force Geophysics Lab., Hanscom AFB, Mass.
ROCKET-BORNE SPECTRAL MEASUREMENT OF ATMOSPHERIC INFRARED EMISSION DURING A QUIET CONDITION IN THE AURORAL ZONE Environmental Research Papers
N. B. Wheeler, A. T. Stair, Jr., G. Frodsham, and D. J. Baker 27 Oct. 1976 102 p refs
(AD-A038250; AFGL-TR-76-0252; AFGL-ERP-582; DNA-HAES-32) Avail: NTIS HC A06/MF A01 CSCL 04/1

A Nike-Javelin rocket (NJ-74-1) was launched at Poker Flat,

Alaska, on 11 Apr 74 at 0801 hours UT during a non-auroral condition. A near-zenith spectral radiance profile was obtained from 54 km to an apogee of 118 km on ascent and from 118 km down to about 85.6 km on descent, using a circular variable filter spectrometer. About 464 spectral scans were obtained during flight, covering the range from 1.7 to 5.4 micrometers at a resolution of about 4 percent. The dominant emission feature was at 4.3 micrometers, which is attributed to the CO2 nu3 fundamental. The upward viewed spectral radiance appeared to range from about 215 MRmicrometer at 54 km to less than the noise equivalent spectral radiance of 3 MR/micrometer at 118 km. In this report are given the first quiet condition (no aurora) rocket data in the auroral zone. Author (GRA)

N77-28669# Air Force Geophysics Lab., Hanscom AFB, Mass.
LWIR (7-24 MICROMETER) MEASUREMENTS FROM THE LAUNCH OF A ROCKETBORNE SPECTROMETER INTO AN AURORA, 1973 Interim Report
James W. Rogers, A. T. Stair, Jr., Ned B. Wheeler, Clair L. Wyatt, and Doran J. Baker 15 Nov. 1976 127 p refs
(AD-A038239; AFGL-TR-76-0274; AFGL-ERP-583; DNA-HAES-51) Avail: NTIS HC A07/MF A01 CSCL 04/1

A liquid-helium-cooled, long-wavelength infrared (LWIR) spectrometer was successfully launched by the Air Force Geophysics Laboratory onboard a Black Brant VC rocket (A18.006-2) on 22 Mar. 1973 from the University of Alaska's Poker Flat Research Range at Chatanika, Alaska. This flight was part of the Defense Nuclear Agency ICECAP 73 Program. The spectrometer, which employs a circular-variable filter (CVF), was developed by AFGL and Utah State University and has provided the first measurements of the altitude profile of the infrared spectrum of the upper-atmospheric emissions between 7 and 24 micrometers. During an IBC II aurora, data were obtained on the 15-micrometer carbon dioxide emission from 65 to 150 km and on the 9.6 micrometer ozone emission between 45 and 100 km. In addition, emission data on the long-wavelength wing of the 6.3 micrometer water band between 6.7 and 7.6 micrometers were also obtained between 50 and 75 km. Above 100 km, significant unidentified emission was observed at 9.3 micrometers with weaker features at 6.9, 7.3, 8.0, 11.1, and 12.3 micrometers. This report documents in detail the data obtained along with the rocket and payload performance, the auroral conditions at launch and a comparison with theoretical models. GRA

N77-28670# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
MICROEARTHQUAKE MONITORING AT CORPS OF ENGINEERS FACILITIES Interim Report
David M. Patrick Feb. 1977 95 p refs
(AD-A038896; WES-TR-S-77-2) Avail: NTIS HC A05/MF A01 CSCL 17/10

Awareness of potential seismicity induced by the filling of large reservoirs or by the injection of fluids in boreholes has prompted the Corps of Engineers and others to conduct microseismic monitoring programs at ten damsites and at one injection well. Two other damsites have been monitored by other organizations in cooperation with the Corps of Engineers, and one is proposed. These programs were developed to measure and compare ambient seismicity in the environs of the installations and the seismicity present during either reservoir filling or fluid injection. GRA

N77-28671# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
A QUANTITATIVE MODEL OF IONOSPHERIC ELECTRON DENSITY Annual Report
W. P. Olson and K. A. Pfitzer Feb. 1977 25 p
(Contract N00014-75-C-0821)
(AD-A038202) Avail: NTIS HC A02/MF A01 CSCL 04/1

This annual report is concerned with work in progress on the development of a quantitative global model of the density of electrons, Ne, in the upper atmosphere. Knowledge of the ionosphere electron density is essential for the quantitative determination of radio wave propagation through this region of the earth's environment. Ultimately Ne will be described on a completely physical basis. This approach to the electron density problem has been taken by NRL and should eventually provide the best models of Ne. The purpose of the current contract has been to provide the current best model for the electron density. In order that this model be useful to groups whose function is impacted by ionospheric variability on communications, the model must meet several requirements. First, it must be global (there have been several models developed of Ne for a given latitude of local time region. They all encounter difficulties when attempts are made to link them with models describing other regions). The model must be analytic. There are two reasons for this. First, an analytic model will almost certainly be capable of being described in a computer code that is fast running. Second, the model almost has to be analytic if it is to be used to describe in real time changes in Ne. It is also prudent to use an analytic model to determine total electron content (TEC) by integrating Ne along some path. The model is intended only to describe gross features of the ionosphere and their temperal variations. It is not capable of describing the more isolated rapid fluctuations in Ne that occur in some regions of the ionosphere. GRA

N77-28672# Naval Research Lab., Washington, D. C.
SEMIDIURNAL HOUGH MODE EXTENSIONS IN THE THERMOSPHERE AND THEIR APPLICATION Interim Report
Richard S. Lindzen, Siv Shung Hong (Cooperative Inst. for Res. in Environ. Sci., Boulder, Colo.), and Jeffrey Forbes (Boston Coll., Mass.) Feb. 1977 81 p refs Sponsored in part by DNA
(AD-A038240; NRL-MR-3442) Avail: NTIS HC A05/MF A01 CSCL 04/1

Semidiurnal tidal modes propagate vertically without change of meridional structure in the lower atmosphere. However, in the thermosphere where viscosity, ion drag, and other processes assume importance, individual tidal modes, propagating into the thermosphere from below, begin to change meridional structure as they propagate vertically. In addition, the modes are subject to attenuation. The extent of meridional alteration and vertical attenuation depends on the mean thermal structure of the thermosphere and the degree of ionization, both of which vary during the solar cycle. This note gives the results of numerical calculations of the explicit behaviour of the 2,2, 2,3, 2,4, and 2,5 Hough modes within the thermosphere under conditions typical of sunspot maximum and minimum. In addition we present a numerical description of semidiurnal tides excited within the thermosphere. For the convenience of the reader a copy of a paper by Hong and Lindzen giving details of the numerical program is included. The present report can be considered an extensive addendum to this paper. Author (GRA)

N77-28673# Naval Surface Weapons Center, Dahlgren, Va. Warfare Analysis Dept.
A GRAVITATIONAL POTENTIAL FOR ATMOSPHERIC EARTH TIDES CAUSED BY THE MOON Final Report
R. Manrique and W. Groeger Nov. 1976 20 p refs
(AD-A038155; NSWC/DL-TR-3638) Avail: NTIS HC A03/MF A01 CSCL 04/1

A potential function is presented for the force by which the atmospheric tide bulge acts on orbits of artificial earth satellites. The tidal bulge is assumed to result from the fact that the earth rotates within the field of lunar mass attraction, the latter being inhomogeneous across the terrestrial globe. Only the main term of the semidiurnal tide is considered in this report. The perturbing acceleration associated with the tide potential is also specified. The latter is intended for use with computer programs for satellite geodesy. Author (GRA)

N77-28674# Stanford Research Inst., Menlo Park, Calif.
ICECAP 75: CHATANIKA RADAR RESULTS Technical Report, Feb. 1975 - May 1976
Paul D. Perreault, Richard R. Vondrak, and Theodore M. Watt May 1976 167 p refs
(Contract DNA001-74-C-0167)
(AD-A038259; DNA-4086T; HAES-43) Avail: NTIS HC A08/MF A01 CSCL 04/1

Results of the Chatanika DNA 617 Radar support coverage of the ICECAP '75 operation are presented, along with magnetometer, riometer, all-sky-camera, and boresite television data gathered to give a more complete picture of ionospheric processes. Eight instrumented rockets were launched during the period 26 February

through 12 March 1975 as part of the ICECAP '75 program. Two daytime launches--Astrobee D probes on 26 February and 1 March 1975--took place during periods of relatively quiet geomagnetic activity when peak energy deposition, due to precipitating electrons, was of order 0.1 ergs/sq cm2-s or less. Maximum E-layer electron densities were less than 100,000 cc. A twilight launch on 6 March (at 0343 UT) also occurred during relatively quiet geomagnetic conditions. E-layer electron densities of less than 100,000 cc and electric field strengths of less than 5 mV/m resulted in low rates of joule dissipation and energy deposition. The four evening launches (6, 10, 11, and 12 March) occurred during periods of moderate to high geomagnetic activity. Total energy deposition rates ranged from 2 to as high as 50 ergs/sq cm2-s and were associated with high electron precipitation and electric field strengths. Author (GRA)

N77-28675# Avco-Everett Research Lab., Everett, Mass.
TURBULENCE ENVIRONMENT CHARACTERIZATION Interim Report, 15 Oct. 1975 - 15 Sep. 1976
M. G. Miller and P. L. Zieske Mar. 1977 114 p refs
(Contract F30602-76-C-0054)
(AD-A038632; RADC-TR-77-70) Avail: NTIS HC A06/MF A01 CSCL 04/1

This report covers some aspects of our investigations of atmospheric turbulence as it relates to the propagation of electromagnetic waves. The major emphasis in this report is a presentation and discussion of data obtained during the last year with a variety of experimental systems deployed at the ARPA Maui Optical Station (AMOS) atop Haleakala on the island of Maui, Hawaii. A brief discussion of the operational aspects and status of the instrumentation is also included. Estimates of the correlation scale, r sub o, were obtained on 24 nights (a total data set of 228 points) using the Seeing Monitor. The measured mean value is 9.6 cm with a range of (5.3 - 17.8) cm at 5000 A. The uncertainty in the measurements is estimated to be of order (5 - 10)%. Absolute calibration of the entire system is the major uncertainty. A variety of effects including trends and apparent nonstationarity effects were observed. Estimates of high altitude turbulence profiles obtained with the Star Sensor indicate a flattening and in some cases an increase in turbulent strength in the vicinity of the meteorological tropopause. Log-Amplitude variances integrated over the 36 cm aperture of this device have a mean value of 0.00058 and a range of 0.00015-0.00028. Nonstationarity effects were often observed. Comparative and simultaneous scintillation measurements show good agreement. Internal agreement of the optical observations with empirical turbulence profile information is not good. Rough agreement exists with theoretical calculations using the Hufnagel wind correlated model. Agreement with other observations is reasonable. GRA

N77-28676# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE EFFECTS OF UNCERTAINTIES IN THE TWO-BODY ION-ION RECOMBINATION COEFFICIENT UPON COMPUTED ION DISTRIBUTIONS IN THE STRATOSPHERE AND MESOSPHERE Final Report
Joseph M. Heimerl Mar. 1977 23 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A038263; BRL-1972) Avail: NTIS HC A02/MF A01 CSCL 20/8

A version of the AIRCHEM code (BENCHMARK-76) has been used to study the sensitivity of the daytime ionic populations to decade changes in selected values of the two-body ion-ion recombination rate coefficient over the altitude range 30-80 km, inclusive. At one extreme, computed ionic populations change by as much as a factor of two in isolated cases. At the other extreme much smaller changes are computed. Author (GRA)

N77-28677# M&S Computing, Inc., Huntsville, Ala.
PAR AURORAL STUDY. VOLUME 6: EFFECT OF SIDELOBES ON THE OPERATION OF THE PAR IN AURORA AND THE EFFECTS OF AURORALLY GENERATED NOISE IN THE PAR FREQUENCY BAND Interim Report
P. L. Alley, J. L. Brown, and M. J. Mitchell 10 Dec. 1976 75 p refs
(Contract DASG60-74-C-0026)
(AD-A036212; Rept-76-0075; Rept-6) Avail: NTIS HC A04/MF A01 CSCL 17/9

The report describes the data collected in connection with research of aurora borealis effects on the performance of a phased array radar. The primary objective of the study was to advance the understanding of the auroral phenomenon and of its interactions with radar. A multi-megawatt phased array radar was used to collect large quantities of high resolution auroral backscatter data with simultaneous tracking of a number of selected satellites. The report provides a detailed description of the data collection process and data reduction techniques in connection with auroral storms. Author (GRA)

N77-28678# ENSCO, Inc., Springfield, Va.
IMPROVED PROCEDURES FOR DETERMINING SEISMIC SOURCE DEPTHS FROM DEPTH PHASE INFORMATION Quarterly Report, 1 Jul. - 30 Sep. 1976
Edward Page, Richard Houck, and Robert Bauman Sep. 1976 19 p
(Contract F08606-76-C-0003; ARPA Order 2551)
(AD-A036443) Avail: NTIS HC A02/MF A01 CSCL 08/11

Differential travel times for the propagation modes sP-P, sPP-PP, sPPP-PPP and sPcP-PcP were computed and polynominal surface fitted for computer access. Author (GRA)

N77-28679# Air Force Geophysics Lab., Hanscom AFB, Mass.
CRYOGENIC SPECTROMETRY FOR THE MEASUREMENT OF AIRGLOW AND AURORA
A. T. Stair, Jr. 1976 8 p refs Submitted for Publication
(AD-A036220; AFGL-TR-77-0042) Avail: NTIS HC A02/MF A01 CSCL 14/2

The status and history of liquid nitrogen and helium cooled optical sensors are reviewed with summary details on those instruments developed and data obtained by this laboratory and our principal contractors. A liquid nitrogen cooled field widened interferometer spectrometer covering the spectral range 1 - 2.5 micrometer has been developed to operate on the ground and has the best NESR (Noise Equivalent Spectral Radiance) of all developed sensors. Atmospheric emissions limit the advantages of cryogenic technology for ground based observations at longer wavelengths. Aircraft and balloon-borne systems are discussed, but emphasis is placed on the rocket-borne sensors developed and flown under the ICECAP program sponsored by the Defense Nuclear Agency (DNA) and the AFGL. The low resolution spectrometers use circular variable filters (CVF) as the spectral resolution element. The high resolution spectrometer is an interferometer cooled with supercritical helium. GRA

N77-28680# Air Force Geophysics Lab., Hanscom AFB, Mass. Aeronomy Div.
THEORETICAL EXPLANATION OF SPECTRAL SLOPES IN STRATOSPHERIC TURBULENCE DATA AND IMPLICATIONS FOR VERTICAL TRANSPORT Scientific Interim Report
Edmond M. Dewan 18 Oct. 1976 49 p refs
(AF Proj. 6687)
(AD-A036307; AFGL-TR-76-0247; AFGL-ERP-581) Avail: NTIS HC A03/MF A01 CSCL 04/1

This paper is motivated by the requirement to improve understanding of vertical motion of pollutants in the stratosphere. One method to estimate vertical transport due to the effects of turbulence is by means of the effective diffusivity coefficient. To calculate this parameter, it is often necessary to know the value of epsilon, the rate of turbulent dissipation. This parameter, epsilon, is also important to know in the context of the global numerical stratospheric simulation models now being created for environmental assessment purposes. GRA

N77-28681# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
TEMPERATURE MEASUREMENTS IN THE STRATOSPHERE FROM BALLOON-BORNE INSTRUMENT PLATFORMS, 1968 - 1975
Harold N. Ballard, Miguel Izquierdo, Carlos McDonald, and John Whitacre Dec. 1976 58 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A036333; ECOM-5808) Avail: NTIS HC A04/MF A01 CSCL 04/1

Six balloon-borne experiments under the title Stratospheric

Composition Experiments were originally designed to measure the temperature variations near an altitude of 50 km that were to be associated with the diurnal tide. Requirements for information concerning stratospheric composition, as well as measurements of interest to the possible pollution of the stratosphere by the Supersonic Transport and by the chlorofluorocarbons, gradually increased the number, types, and complexity of measurements conducted during each successive flight. During each flight, something was learned about techniques, sources of thermal contamination, and operational procedures which must be followed to accurately measure the correct atmospheric temperature with the balloon-borne film-mounted thermistor sensors. The temperature data obtained in the stratosphere from these six flights gives information which is indicative of the temperature variations which occur at a specific altitude in a parcel of air moving with the balloon within time intervals of 3 to 12 hours. GRA

N77-28682# Lockheed Missiles and Space Co., Palo Alto, Calif. Space Sciences Lab.

LOW-ENERGY PARTICLE EXPERIMENT Annual Technical Report, 1 Apr. 1976 - 31 Mar. 1977

Edward G. Shelley 30 Mar. 1977 58 p refs

(Contract N00014-72-C-0234; NR Proj. 323-014)

(AD-A039763; LMSC/D558252) Avail: NTIS HC A04/MF A01 CSCL 04/1

This program is directed toward an improved understanding of the sources and the energization, transport and loss processes associated with the low-energy (keV) plasmas in the earth's magnetosphere. A low-energy particle experiment was launched on the Air Force S3-3 satellite in July of 1976. The experiment is operating completely successfully and has already made several major discoveries about previously unknown ionospheric acceleration mechanisms and the composition of the ring current. Author (GRA)

N77-28683# Environmental Technical Applications Center, Scott AFB, Ill.

DEW LINE NARRATIVE REFRACTIVE INDEX CLIMATOLOGIES

James A. Warnke and Jeanette M. Heumann Nov. 1976 52 p refs

(AD-A040089; USAFETAC-8056) Avail: NTIS HC A04/MF A01 CSCL 04/1

The categories of normal and abnormal propagation conditions are used to describe the propagation conditions for each season at 13 locations in Alaska, Canada, and Greenland. Meteorological factors that influence the climate are related to the resulting propagation climatologies. Author (GRA)

N77-28684# Airborne Instruments Lab., Deer Park, N.Y.

IHR (INFRARED HETERODYNE RADIOMETER) FOR LOW ALTITUDE TEMPERATURE RETRIEVAL Annual Report, Apr. 1976 - Apr. 1977

I. Rubinstein Apr. 1977 37 p refs

(Contract N00014-76-C-0721)

(AD-A039861; AIL-C618-1) Avail: NTIS HC A03/MF A01 CSCL 04/1

A technique for obtaining accurate temperature and humidity profiles with a grazing-angle up-looking radiometer has been investigated. The profiling technique is based on information retrievals which are obtained from difference-Kernel functions generated from pairs of high spectral resolution radiometric channels. Spatially selective information can be generated from such functions with the required accuracy for retrieving temperature gradients at the lower altitude atmospheric levels. GRA

N77-28685# Naval Postgraduate School, Monterey, Calif.

A THREE PLATFORM EXPERIMENT ON OPTICAL TURBULENCE IN THE MARINE BOUNDARY LAYER M.S. Thesis

Richard Henry Paine Mar. 1977 67 p refs

(AD-A039789) Avail: NTIS HC A04/MF A01 CSCL 04/1

An observational experiment was conducted in the marine boundary layer off the California coast involving optical turbulence measurements. The measurements were made from a ship, a tethered kite and two C-135 aircraft. Measured values of C(n) squared from the surface to levels above the marine inversion were related to the synoptic weather situation. C(n) squared values were observed to be maximum in the inversion. Near surface C(n) squared values, measured from two levels on the ship, exhibited expected diurnal changes. Overall, C(n) squared values measured optically (scintillation) and meteorologically (from C(T) squared measurements) compared satisfactorily. C(n) squared profiles estimated from surface observed values using a z to the -4/3 power assumed distribution appeared to define the mean measured profile. GRA

N77-28686# Radiation Research Associates, Inc., Fort Worth, Tex.

CALCULATIONS OF THERMAL RADIATION TRANSMISSION THROUGH CLOUDS

D. G. Collins 6 May 1977 34 p ref Presented at Ann. Satellite Diagnostic Working Group Meeting, Patrick AFB, Fla., (Contract F08606-77-C-0008)

(AD-A039543; RRA-M7704; AFTAC-TR-77-16) Avail: NTIS HC A03/MF A01 CSCL 04/1

This paper discusses the difficulties encountered when attempting to run cloud transmission calculations using the point receiver estimating function in the POLO program. The spherical surface receiver estimating routine incorporated into a new version of the POLO program is described. Cloud transmission calculations using the two versions of the POLO program are compared for receivers at synchronous satellite positions and for receivers at the cloud top. Author (GRA)

N77-28687# National Bureau of Standards, Washington, D. C. Center for Building Technology.

HOURLY SOLAR RADIATION DATA FOR VERTICAL AND HORIZONTAL SURFACES ON AVERAGE DAYS IN THE UNITED STATES AND CANADA Final Building Science Series Report

T. Kusuda and K. Ishii Apr. 1977 416 p refs

(PB-265551/2; NBS-BSS-96) Avail: NTIS HC A18/MF A01 CSCL 04A

The technique that was used to compute and tabulate the monthly average incident radiation on an hourly basis during the day for each month of the year, and each of eight different vertical orientations is outlined. The data were tabulated for 80 different locations in the United States and Canada. An additional parameter called sol-air temperature for glass was also computed and tabulated for each of the locations. GRA

N77-28688# National Geodetic Survey, Rockville, Md.

RECENT ELEVATION CHANGE IN SOUTHERN CALIFORNIA

S. R. Holdahl Feb. 1977 26 p refs

(PB-265940/7; NOAA-TM-NOS-NGS-7; NOAA-77031802) Avail: NTIS HC A03/MF A01 CSCL 08G

Velocities of elevation change for two time periods were determined from Southern California leveling data. Two periods were selected for study: 1906 through 1962 and 1959 through 1976. The study area extends from San Pedro north to latitude 35.5 degrees, and between longitudes 117 degrees and 119.5 degrees. The shape of the fitted velocity surface for the latter epoch agrees with the original uplift established by Castle et al. (1976) with the exception that no eastern termination is evidenced within the study area. The velocity surface for the earlier time period shows negligible subsidence of 1 mm/yr at Palmdale, increasing to 9 mm/yr at Bakersfield. The 11 mm/yr maximum uplift velocity determined for the period 1959 through 1976 is approximately twice the corresponding standard deviation. Weighted velocities, extracted from tidal records at six stations on the coast, were used to provide input for absolute height change. GRA

N77-28689# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.

SOLAR RADIATION ATMOSPHERIC TRANSMISSION RESEARCH, PHASE 1 Final Report

G. M. Lerfald, V. E. Derr, R. F. Pueschel, and R. L. Hulstrom (Martin Marietta Corp., Denver) Jan. 1977 162 p refs

(PB-266010/8; NOAA-TM-ERL-WPL-18; NOAA-77031804) Avail: NTIS HC A08/MF A01 CSCL 04A

Part 1 reviews the overall work program and states conclusions and recommendations. Part 2 is a detailed analysis of solar photometric data collected on two days; a summer day with relatively large amount of atmospheric water vapor and

some aerosol content, and a winter day, which had clear dry conditions. Results demonstrate the utility of using spectral data to differentiate between absorbing components and the importance of having additional data (cloud condition data) when attempts are made to estimate direct irradiance values from total hemispherical (pyranometer) data. GRA

N77-28690# Avco-Everett Research Lab., Everett, Mass.
ATMOSPHERIC TRANSMITTANCE MODELING FOR TEMPERATURE AND WATER VAPOR USING SATELLITE INFRARED DATA
B. Kivel Dec. 1976 46 p refs
(Contract NOAA-6-35161)
(PB-266414/2; NOAA-77032919) Avail: NTIS HC A03/MF A01 CSCL 04B

It is suggested that the standard deviation in the difference between inferred atmospheric properties and ground truth observations might be reduced by using specific models depending on auxiliary data and averaging the parameters in the models over limited classes of data. A simple model is found for broad ocean areas with minimal cloud cover that gives values of the atmospheric temperature on the average to about one degree with a 4K standard deviation. The model also gives on the average the correct value of the water mixing ratio with a standard deviation in the ratio of derived to measured of 44%. GRA

N77-28691# National Ocean Survey, Rockville, Md. Geodetic Research and Development Lab.
ALGORITHMS FOR COMPUTING THE GEOPOTENTIAL USING A SIMPLE-LAYER DENSITY MODEL
Foster Morrison Mar. 1977 49 p refs
(PB-266967/9; NOAA-TR-NOS-67; NGS-3; NOAA-77040501)
Avail: NTIS HC A03/MF A01 CSCL 08E

Several algorithms were developed for computing the gravitational attraction of a simple-density layer; these are numerical integration, Taylor series, and mixed analytic and numerical integration of a special approximation. A computer program was written to combine these techniques for computing the higher frequency components of the gravitational acceleration of an artificial earth satellite. The special approximation is used in the sub-satellite region, Taylor series in a surrounding zone, and numerical quadrature in the remaining regions. Numerical tests comprising integrations of equations of satellite motion and static gravity simulations indicate the simple density layer model is feasible. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N77-28692 California Univ., Los Angeles.
THE MICROZONATION FOR WIND EFFECTS ON STRUCTURES Ph.D. Thesis
Marshall Lew 1976 661 p
Avail: Univ. Microfilms Order No. 77-2918

As an example of the application of the microzonation procedure, the Los Angeles and Orange Counties regions were microzoned. This procedure includes: (1) examination of the meteorological causes of strong local winds, (2) the acquisition of extreme wind data, (3) evaluation of the wind exposure or surface roughness at each wind instrument location, (4) reduction of all extreme wind data to a common basis, (5) statistical analysis of the reduced wind data, (6) prediction of extreme wind speeds for different recurrence intervals, (7) incorporation of any other relevant wind data that could improve the knowledge of the behavior of extreme winds, and (8) the microzonation of the region according to predicted extreme wind speeds for different levels of risk. These could be used as a basis for determining design wind loads. Dissert. Abstr.

N77-28693*# TRW Systems and Energy, Redondo Beach, Calif.
ANALYTIC STUDIES OF LOCAL-SEVERE-STORM OBSERVABLES BY SATELLITES Final Report
Paul Dergarabedian and Francis Fendell Washington NASA Jul. 1977 60 p refs
(Contract NAS1-14001)
(NASA-CR-2830) Avail: NTIS HC A04/MF A01 CSCL 04B

Attention is concentrated on the exceptionally violet whirlwind, often characterized by a fairly vertical axis of rotation. For a cylindrical polar coordinate system with axis coincident with the axis of rotation, the secondary flow involves the radial and axial velocity components. The thesis advanced is, first, that a violent whirlwind is characterized by swirl speeds relative to the axis of rotation on the order of 90 m/s, with 100 m/s being close to an upper bound. This estimate is based on interpretation of funnel-cloud shape (which also suggests properties of the radial profile of swirl, as well as the maximum magnitude); an error assessment of the funnel-cloud interpretation procedure is developed. Second, computation of ground-level pressure deficits achievable from typical tornado-spawning ambients by idealized thermohydrostatic processes suggests that a two-cell structure is required to sustain such large speeds. Author

N77-28694# Rome Air Development Center, Griffiss AFB, N.Y.
AUTOMATED WEATHER DATA DISSEMINATION FEASIBILITY MODEL Final Report
Brian L. Masson Feb. 1977 50 p refs
(AD-A038059; RADC-TR-76-332) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes a study conducted to determine the feasibility of developing an inexpensive microprocessor-based system to accept raw weather data from Air Force inventory sensors and process this data for display. A feasibility model was built at RADC with an Intel Model 8080 microprocessor, and attempts were made to interface with the following sensors: the AN/GMQ-13 Rotating Beam Ceilometer, the AN/GMQ-10 Transmissometer, the AN/TMQ-11 Temperature/Dew Point Sensor, and the AN/GMQ-2 Wind Instrument. This report details the design of the feasibility model and discusses the results of the study. Author (GRA)

N77-28695# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF SMALL SCALE HUMIDITY FLUCTUATIONS IN THE MARINE BOUNDARY LAYER M.S. Thesis
William Leroy Shutt Dec. 1976 64 p refs
(AD-A038899) Avail: NTIS HC A04/MF A01 CSCL 04/2

Humidity spectra were measured with the Lyman-alpha humidiometer, together with mean profiles of virtual potential temperature, wind, and humidity in the open ocean environment. Empirically derived expressions describing the temperature structure parameter were extended by similarity arguments to the humidity-structure parameter, (C sub q) squared, and (C sub q) squared was related to the stability parameter Ri. Using the above measured parameters, vertical humidity flux was computed in two different manners, and a comparison was made. In general, there was little correlation between the spectrally analyzed (C sub q) squared values and Ri. Results for (C sub q) squared can essentially be regarded as a function of z and humidity gradient. Non-dimensional (C sub q) squared results were generally an order of magnitude smaller than expected. No correlation between the two methods of calculation of humidity flux was found. GRA

N77-28696# Cramer (H.E.) Co., Inc., Salt Lake City, Utah.
MIXING-LAYER ANALYSIS ROUTINE AND TRANSPORT/DIFFUSION APPLICATION ROUTINE FOR EPAMS Final Report
R. K. Dumbauld and J. R. Bjorklund Mar. 1977 182 p refs
(Contract DAAB07-76-C-0023)
(AD-A038399; TR-76-106-01; ECOM-77-2) Avail: NTIS HC A09/MF A01 CSCL 04/2

This report describes the development of two subelements of the U.S. Army Experimental Prototype Automatic Meteorological System (EPAMS). One of the subelements is a diagnostic routine (computer program) for the automatic calculation of the mixing depth, as well as the wind velocity and other meteorological parameters in the surface mixing layer, for a mesoscale calculation grid in complex terrain. The output from this routine is used with the second subelement--a transport/diffusion application routine--to calculate concentration/dosage fields produced by pollutant emissions from selected sources located within the calculation grid. A two-layer shallow-fluid numerical model is

used in the diagnostic routine to calculate the mesoscale wind field. The concentration/dosage fields calculated by the transport/diffusion application routine are obtained by solving generalized dispersion models for both continuous and instantaneous sources. In addition to descriptions of the modeling techniques, calculation procedures and computer program operations, example solutions for several case studies at White Sands Missile Range are also presented. Author (GRA)

N77-28697# Rhode Island Univ., Kingston. Narragansett Marine Lab.

OCEANIC WIND SPEED AND WIND STRESS ESTIMATION FROM AMBIENT NOISE MEASUREMENTS M.S. Thesis

Ping-Tung Shaw, D. Randolph Watts, and H. Thomas Rossby Feb. 1977 81 p refs Prepared in cooperation with Yale Univ. (Contract N00014-76-C-0226; Grant NSF GX-30416)

(AD-A036345; URI/GSO-REF-77-2; NSF-MODE-Contrib-87) Avail: NTIS HC A05/MF A01 CSCL 04/2

From ship records of wind speed and 5 kHz acoustic ambient noise measured on ocean bottom instruments during Mid-Ocean Dynamics Experiment (MODE - I), it was found that noise records may be used to monitor wind speed and wind stress over the ocean. Time series of wind speeds can be produced from noise measurements via the linear relationship found between the noise spectrum level and the logarithm of the wind speed. By independently determining wind direction, the wind stress has also been estimated and vector-averaged. The monthly mean stress from the authors' data is higher than values computed from mean wind speeds or from probability distributions of wind speeds in climatological records. Power spectra of these wind speed records decrease smoothly with increasing frequency for periods between 2 to 50 hours. Noise pressure records exhibited significant coherence between pairs of localities 100 to 200 km apart during the spring, as organized weather fronts passed through the region. GRA

N77-28698# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.

SATELLITE CALIBRATION DATA, 1976 Annual Data Report

L. Edwin Williamson and Louis I. Murillo Mar. 1977 292 p ref

(AD-A039462; ECOM-DR-77-1) Avail: NTIS HC A13/MF A01 CSCL 04/2

This report contains data from observations of meteorological and radiative parameters at selected satellite calibration target sites. These sites include the highly reflective gypsum field in southcentral New Mexico, a dark lava surface, and a fresh water reservoir nearby. The report also contains narrative descriptions of the instruments in use at the target sites. Author (GRA)

N77-28699# Manchester Univ., MacClesfield (England).

ATMOSPHERIC AEROSOL RESEARCH AT UMIST Final Technical Report, Mar. - Dec. 1976

John Latham and M. J. Gay Dec. 1976 68 p (Grant DA-ERO-124-74-G-0032)

(AD-A036494) Avail: NTIS HC A04/MF A01 CSCL 04/1

This report describes the work carried out during the first three years of research devoted to aerosol studies. Some preliminary measurements have been made primarily to ensure the accurate and reliable operation of the various devices installed rather than with any closely defined specific scientific goals in mind at this time. However, two specific aerosol projects have been conducted during this period. The former project is a laboratory investigation of the effects of mixing on the evolution of wet aerosol spectra, and the latter project deals with electrical studies of the turbulent mixing of aerosol trapped at a temperature inversion. The final section of this report briefly describes and discusses recent work carried out and likely future developments. GRA

N77-28700# Naval Postgraduate School, Monterey, Calif.

OPERATIONAL DATA TESTS WITH A TROPICAL CYCLONE MODEL Technical Report, Jul. 1976 - Mar. 1977

Russell L. Elsberry Mar. 1977 33 p refs

(AD-A039183; NPS-63Es77031) Avail: NTIS HC A03/MF A01 CSCL 04/2

The coarse-grid version of Ley and Elsberry tropical cyclone prediction model was used to evaluate the effect of using operationally-analyzed rather than hand-analyzed data. A series of 41 cases from the 1975 typhoon season resulted in larger errors than the official forecasts. In most cases the track was forecast well, but the translation speed was slow. Tests with a 4th-order advection scheme did not lead to significant improvements over the 2d-order advection. It was concluded that the most likely source of error was due to data deficiencies in the western Pacific. Wind direction estimates based on Defense Meteorological Satellite Program (DMSP) photographs were compared to the Joint Typhoon Warning Center (JTWC) hand-analyzed streamlines. About 65-70% of the DMSP direction estimates at the gradient and 250-mb level were within + or - 10 deg of the hand-analyzed fields. The author concludes that the new data source of DMSP direction estimates should be used in operational analysis. GRA

N77-28701# Naval Postgraduate School, Monterey, Calif.

NUMERICAL MODELLING OF THE EVOLUTION OF MONSOON CIRCULATION ALONG 80 DEG E M.S. Thesis

George William Schwenke Mar. 1977 41 p refs

(AD-A039782) Avail: NTIS HC A03/MF A01 CSCL 04/2

The UCLA general circulation model developed by Arakawa and Mintz was used to study the evolution of the northern summer monsoon during a 180 day period commencing in mid January. The global model, modified to a five degree latitude by five degree longitude grid resolution, was run for five vertical levels in a zonally symmetric mode along 80 deg E to permit the extended computational period. Thermal forcing was simulated by continuously adjusting computed temperatures at each level toward the radiative equilibrium temperature for that level as estimated by Palmen and Newton. These equilibrium temperatures were also adjusted during the 180 day period from the January mean to the July mean. The evolution and location of the major zonal components of the monsoon were reasonably simulated. The results indicate that a zonally symmetric model is suitable for studies on the planetary-scale features of the monsoon with the realization that exclusion of zonally-asymmetric phenomena from such a model limits its accuracy and usefulness in considering the effects of such events on the monsoon system. GRA

N77-28702# Naval Postgraduate School, Monterey, Calif.

ON ONE DIMENSIONAL GEOSTROPHIC ADJUSTMENT WITH FINITE DIFFERENCING Interim Report for the period ending Jan. 1977

Arthur L. Schoenstadt Apr. 1977 21 p refs

(AD-A040071; NPS-53ZH77041) Avail: NTIS HC A02/MF A01 CSCL 04/2

A result of Winninghoff (1968) on the effect of finite differencing in the process of geostrophic adjustment in one dimension is shown to be erroneous. The correct result is provided, and Winninghoff's conclusions reexamined. Author (GRA)

N77-28703# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

ENVIRONMENTAL DATA COLLECTED WITH AUTOMATED FIELD STATION AT THE UPPER BLAKELEY ISLAND DISPOSAL AREA, MOBILE, ALABAMA Final Report

Margaret H. Smith, Herman M. Floyd, and Harold W. West Apr. 1977 41 p

(AD-A040004; WES-MP-M-77-5) Avail: NTIS HC A03/MF A01 CSCL 04/2

This report describes the system of instruments and the automated field station used by the WES for the acquisition of environmental data in support of field experiments on methods of densifying dredged material in containment areas at Upper Blakely Island near Mobile, Alabama. Examples of data collected from 18 December 1975 through 12 May 1976 are presented. Included in the report is a comparison of wind speeds measured by the field station instruments with wind speed measured by a Meteorology Research, Inc., weather station. As a result of favorable comparisons in both laboratory and field tests, wind speeds measured by the automated station instruments are deemed accurate and reliable measurements of wind speeds at the containment area on Upper Blakely Island. In addition to wind speed, other data collected by the automated instrumentation

include rainfall, wind direction, solar radiation, air and soil temperature, and pan evaporation. Author (GRA)

N77-28704# Human Ecology Research Services, Inc., Boulder, Colo.

A SOCIETAL ASSESSMENT OF THE PROPOSED SIERRA SNOWPACK AUGMENTATION PROJECT Final Report

Barbara C. Farhar and Ronald Rinkle Jan. 1977 161 p refs
(Contract DI-6-07-DR-20090)
(PB-265246/9) Avail: NTIS HC A08/MF A01 CSCL 04B

A community-level study focused on factors hypothesized to be associated with a community's willingness to experience a cloud seeding project. Data are presented on such variables as weather-related activities of the area, heterogeneity of weather needs, economic well-being, perception of water needs, history of public response to weather modification in the area, media position, compensatory arrangements, and preferred decision-making procedures. The conclusion reached is that the proposed project would likely find social acceptance, especially if certain identified problem areas could be resolved, and recommendations concerning these are offered. GRA

N77-28705# National Weather Service, Salt Lake City, Utah. Scientific Services Div.

THE MAN/MOS PROGRAM

Alexander E. MacDonald Feb. 1977 30 p refs
(PB-265941/5; NOAA-TM-NWS-WR-112; NOAA-77030307)
Avail: NTIS HC A03/MF A01 CSCL 04B

The MAN/MOS (Model Output Statistics) Program was instituted to improve forecasting by making more effective use of MOS and to determine if WSFOs could significantly improve on MOS guidance. A complete description of the methods and results of the program is given. Methods used included: (1) encouraging meteorological reasoning, (2) more careful use of MOS, (3) fostering competition among WSFOs for improvements over MOS, and (4) rapid feedback techniques. Two seasons of PoP (Probabilities of Precipitation) verifications are presented which show substantial improvements overi MOS for Western Region WSFOs, and increased skill in comparison with previous years. GRA

N77-28706# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.

DETECTION OF GUST FRONTS USING SURFACE SENSORS

A. J. Bedard, Jr. and D. W. Beran Feb. 1977 21 p refs
(PB-266421/7; NOAA-TM-ERL-WPL-20; NOAA-77032903)
Avail: NTIS HC A02/MF A01 CSCL 04B

Properties of thunderstorm gust fronts and the surface effects they produce are reviewed with emphasis on density currents and their associated wind shear as a hazard to aircraft. Methods of detection are reviewed in terms of their utility in warning systems for airports. A first-generation warning system is described. It consists of an acoustic Doppler system, a Doppler radar, and a dense array of pressure-jump detectors. It overcomes deficiencies of systems developed previously, which lack sufficient spatial resolution and areal extent for measurements of evolving gust fronts. The research program continuing at WPL to evaluate and optimize the system is documented. GRA

N77-28707# National Center for Atmospheric Research, Boulder, Colo.

COMPARISON BETWEEN DUAL-WAVELENGTH RADAR ESTIMATES AND GROUND MEASUREMENTS OF PRECIPITATION M.S. Thesis - Colorado Univ.

Sergio Reyes 1977 99 p refs
(Contract NSF C-760)
(PB-265727/8; NCAR-CT-41) Avail: NTIS HC A05/MF A01 CSCL 04B

With a dual-wavelength X- and S-band radar (XSR), X-band microwave attenuation is determined and then particle precipitation rate is estimated. Quantities so derived appear independent of large precipitation rates. To test the numerical technique, correlated were the derived precipitation rate and total precipitation depth with ground measurements from northern Colorado. Four cases were considered in the presence and absence of hail: light and heavy precipitation rates and small and large total water deposition. GRA

N77-28708# Arizona Univ., Tucson. Lab. of Tree-Ring Research.

DENDROCLIMATIC VARIABILITY IN THE AMERICAN SOUTHWEST, AD 680 TO 1970 Final Report

Jeffrey S. Dean and William J. Robinson 31 Mar. 1977 150 p refs
(Contract NPS-CX-1595-5-0241)
(PB-266340/9) Avail: NTIS HC A07/MF A01 CSCL 04B

The laboratory of Tree-Ring Research undertook this project to reconstruct paleoclimate in the American Southwest by correlating tree-ring data from throughout the area. The time period of A.D. 680 to 1970 is covered by the study of rings from living trees and from wood samples in archeological sites. Research techniques and the statistical manipulation of the data to obtain results are outlined and discussed. Two appendices include maps showing precipitation gradients at ten-year intervals over the time period covered and an explanation of the computer program used to generate these maps. GRA

N77-28709# National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.

CHARACTERISTICS OF MESO-BETA-SCALE DEEP CONVECTION OVER THE EASTERN TROPICAL ATLANTIC

Lee R. Hoxit May 1976 19 p refs
(PB-266955/4; NOAA-TR-ERL-366; APCL-38;
NOAA-77041314) Avail: NTIS HC A02/MF A01 CSCL 04B

Infrared imagery of SMS/GOES satellites is used to estimate the temporal and spatial variability of isolated mesoscale convective systems over the tropical Eastern Atlantic for a study period (July 17 - Sept. 6, 1974) that includes most of the GATE experimental period. The region along 10 degrees N experiences the greatest frequency of these storms. A pronounced diurnal variation is found in the times of initial development with maximum frequencies near midnight. Typical life cycles encompass roughly 5-10 hours. The data suggest a tedency for these systems to develop in regions of low-level convergence and mid-tropospheric divergence. GRA

N77-28710# National Oceanic and Atmospheric Administration, Silver Spring, Md.

THE WMO REGIONAL PRECIPITATION CHEMISTRY NETWORK IN THE UNITED STATES

John M. Miller and Ross Highsmith Oct. 1976 25 p refs
(PB-266956/2; NOAA-TM-ERL-ARL-60; NOAA-77041315)
Avail: NTIS HC A02/MF A01 CSCL 04A

High-quality precipitation chemistry data are essential for the determination of chemical trends in the atmosphere and for the evaluation of the earth's geological and biological systems. The operation of the U.S. regional network of WMO precipitation sampling stations and suggestions for its improvement are outlined. In addition, a procedures manual detailing sampling rules and equipment and sample handling is given in the appendix. GRA

N77-28711# National Weather Service, Salt Lake City, Utah.

PROGRAM TO CALCULATE WINDS ALOFT USING A HEWLETT-PACKARD 25 HAND CALCULATOR

Brian W. Finke (Natl. Weather Service Forecast Office, Los Angles)
Feb. 1977 12 p refs
(PB-266968/7; NOAA-TM-NWS-WR-115; NOAA-77033105)
Avail: NTIS HC A02/MF A01 CSCL 04B

A method of calculating winds aloft data from theodolite observation is offered without resorting to the use of plotting boards. The tangent plane approximation is the only compromise; but within the accuracy of the observations. The approximation results in no error. GRA

N77-28712# National Weather Service, Kansas City, Mo. Central Region.

AN UPDATED OBJECTIVE FORECAST TECHNIQUE FOR COLORADO DOWNSLOPE WINDS

Wayne E. Sangster Mar. 1977 31 p Sponsored by NOAA
(PB-266966/1; NOAA-TM-NWS-CR-61; NOAA-77033101)
Avail: NTIS HC A03/MF A01 CSCL 04B

An updated objective technique for forecasting the probability of strong westerly downslope winds in the Boulder, Colorado area is presented. Wind events with thresholds of 60 mph and 80 mph in a 6 hour period were related to two-a-day upper-air

observations at upstream stations with a 3-hour lag to the beginning of the verifying period, using the screening regression technique. Binary predictors formed from 85- and 70-kPa height differences, an upstream 70-kPa west wind component, and from vertical temperature differences between 62 and 58 kPa, 58 and 54 kPa, and 40 and 30 kPa at the upstream sounding are used in the technique presented. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N77-28713# Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.

LITTORAL DRIFT ESTIMATES ALONG THE COASTLINE OF FLORIDA

T. L. Walton, Jr. Aug. 1976 132 p refs
(Grant NOAA-04-3-158-43)
(PB-266422/5; Florida Sea Grant-13; NOAA-77032403) Avail: NTIS HC A07/MF A01 CSCL 13B

Littoral drifts are computed on a monthly averaged basis for possible use in feeder beach design and groin system design where a knowledge of seasonal sand movement is important, and in design of jetties where a knowledge of the monthly buildup of sand adjacent to the structure is of beneficial use in planning the construction phase of a project. The more important aspects of the data source and the computational scheme used in the calculations are given. The report then presents an example of the littoral drift computational results with a geomorphological interpretation of a section of coastline using the results. Additionally, heuristic comparisons of monthly littoral drift rates are presented where such comparisons can be made and a summary of the results of this study with implications for use of the data is given. GRA

N77-28714# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.

OCEANOGRAPHY VARIATIONS ACROSS THE GULF STREAM OFF CHARLESTON, SOUTH CAROLINA DURING 1965 AND 1966

John B. Hazelworth Sep. 1976 80 p refs
(PB-266990/1; NOAA-TR-ERL-383; AOML-25;
NOAA-77033001) Avail: NTIS HC A05/MF A01 CSCL 08J

The ship PEIRCE of the United States Coast and Geodetic Survey conducted a physical oceanographic program across the Gulf Stream off Charleston, South Carolina. The project consisted of a series of cruises, one every two weeks, from August 1965 to July 1966. The primary objectives of the program were to investigate the variability of the physical properties and to record the dynamic variability of the Gulf Stream over a period of one year. This report describes the measurements taken and the methods applied to correct and analyze the hydrographic station data. Cross-section of each physical property for each cruise are presented. Geostrophic currents and volume transport calculations are presented. Results of water mass analysis by use of the T/S curve and also by use of the oxygen-density relationship are given. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N77-28715# Hawaii Univ., Honolulu. Water Resources Research Center.

ALGA GROWTH POTENTIAL OF WASTE WATER EFFLUENTS IN HAWAIIAN RECEIVING WATERS Final Report, 1 Jul. 1975 - 30 Sep. 1976

Reginald H. F. Young, Eassie M. Miller, and Ivan K. Nakatsuka Nov. 1976 58 p refs
(Contract DI-14-34-0001-6012)
(PB-265172/7; TMR-52; OWRT-A-065-HI(1); W77-05852) Avail: NTIS HC A04/MF A01 CSCL 13B

A laboratory study was conducted to determine the algal growth potential (AGP) of secondary domestic effluents on stream and marine waters in Hawaii. AGP methods developed by the Environmental Protection Agency were used with effluent-receiving water mixtures representative of nutrient levels found in existing effluent disposal situations. Results of this study are indicative that growth response follows similar patterns for conventional biologically-treated effluents in the four fresh receiving waters tested, with peak growth occurring at a 20% dilution of the effluent. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N77-28716* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CORNEAL SEAL DEVICE Patent

Edward F. Baehr, inventor (to NASA) Issued 5 Jul. 1977 7 p Filed 13 Apr. 1976 Supersedes N76-22891 (14 - 13, p 1709)
(NASA-Case-LEW-12258-1; US-Patent-4,033,349;
US-Patent-Appl-SN-676433; US-Patent-Class-128-303R;
US-Patent-Class-128-1R) Avail: US Patent Office CSCL 06B

A corneal seal device is provided which, when placed in an incision in the eye, permits the insertion of a surgical tool or instrument through the device into the eye. The device includes a seal chamber which opens into a tube which is adapted to be sutured to the eye and serves as an entry passage for a tool. A sealable aperture in the chamber permits passage of the tool through the chamber into the tube and hence into the eye. The chamber includes inlet ports adapted to be connected to a regulated source of irrigation fluid which provides a safe intraocular pressure. Official Gazette of the U.S. Patent Office

N77-28717* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

SNAP-IN COMPRESSIBLE BIOMEDICAL ELECTRODE Patent

James D. Frost, Jr. (Methodist Hospital, Houston) and Carl E. Hillman, Jr., inventors (to NASA) (Methodist Hospital, Houston) Issued 5 Jul. 1977 4 p Filed 3 Dec. 1975 Supersedes N76-13735 (14 - 04, p 0488) Sponsored by NASA
(NASA-Case-MSC-14623-1; US-Patent-4,033,334;
US-Patent-Appl-SN-637269; US-Patent-Class-128-2.1E;
US-Patent-Class-128-410; US-Patent-Class-128-DIG.4) Avail: US Patent Office CSCL 06B

A replaceable, prefilled electrode enclosed in a plastic seal and suitably adapted for attachment to a reusable, washable cap having snaps thereon is disclosed. The apparatus is particularly adapted for quick positioning of electrodes to obtain an EEG. The individual electrodes are formed of a sponge body which is filled with a conductive electrolyte gel during manufacture. The sponge body is adjacent to a base formed of a conductive plastic material. The base has at its center a male gripper snap. The cap locates the female snap to enable the electrode to be positioned. The electrode can be stored and used quickly by attaching to the female gripper snap. The snap is correctly positioned and located by mounting it in a stretchable cap. The cap is reusable with new electrodes for each use. The electrolyte gel serves as the contact electrode to achieve a good ohmic contact with the scalp. Official Gazette of the U.S. Patent Office

N77-28718 Indiana Univ., Bloomington.

THE DYNAMIC FUNCTION OF SELECTED MUSCLES OF THE FOREARM: AN ELECTROMYOGRAPHICAL AND CINEMATOGRAPHICAL ANALYSIS Ph.D. Thesis

Calvin Sabin Fisk 1976 187 p
Avail: Univ. Microfilms Order No. 77-1958

The lateral head of the triceps brachii, flexor carpi ulnaris, flexor carpi radialis, and pronator teres muscles were studied during the performance of the overhand baseball throw. Indwelling differential bipolar fine-wire electrodes were employed to record action potentials produced by these muscles. Seven experienced and five inexperienced subjects each performed two straight

throws with spin. Electro-myograms were recorded by an Offner Dynograph and cinematographic data was recorded by a high-speed LOCAM camera at 200-400 frames per second on 16 mm film. The data revealed noticeable differences between the experienced and the inexperienced performers. Experimental percentages were relatively consistent among the experienced performers, whereas the contractions of the inexperienced performers were eratically strong or weak. Experienced performers displayed consistent early contractions during both types of throws. Dissert. Abstr.

N77-28719 Michigan Univ., Ann Arbor.
THE ROLE OF POTASSIUM IN THE CONTROL OF THE CORONARY CIRCULATION: MECHANISM OF ACTION AND TIME COURSE Ph.D. Thesis
Paul Alan Murray 1976 152 p
Avail: Univ. Microfilms Order No. 77-8002

Forty micromole bolus injections of isosmotic KCl into the circumflex artery of the open-chest dog were found to decrease CVR (coronary vascular resistance) from 34 to 48 percent. These injections had no effect on heart rate, and produced small, but significant, decreases in mean arterial pressure and myocardial oxygen consumption. The magnitude of K+-induced vasodilation was not significantly affected by the administration of propranolol, atropine, cr phentolamine. However, K+-induced vasodilation was significantly attenuated by ouabain-lidocaine. This inhibitory action seemed to be primarily due to the effects of ouabain, since lidocaine alone did not significantly decrease the magnitude of the vascular response. Dissert. Abstr.

N77-28720 Florida Univ., Gainesville.
AN ANALYSIS OF THE CONTRIBUTION OF SMALL AIRWAYS TO LOWER AIRWAY RESISTANCE Ph.D. Thesis
John Newton Evans 1976 119 p
Avail: Univ. Microfilms Order No. 77-6867

It was shown that the contribution of peripheral airways to lower pulmonary resistance in closed chest dog is significantly greater than that measured following the opening of the chest. The reduction of peripheral resistance is mainly mediated through an increased beta adrenergic receptor stimulation in the peripheral airway. The influence of sympathetic input on the tonus of peripheral airway smooth muscle is minimal in the closed chest dog and only becomes significant when the chest is opened. In spite of the reductions in R sub P, due to opening of the chest there were no significant changes in R sub L which means that central resistance increased in a magnitude equal to the reduction of R sub P. The possiblility of maintenance of a constant R sub L at a given lung volume by coordinated changes in R sub C to offset changes R and L is suggested. Dissert. Abstr.

N77-28721*+ National Aeronautics and Space Administration, Washington, D. C.
A CUMULATIVE INDEX TO THE 1976 ISSUES OF A CONTINUING BIBLIOGRAPHY ON AEROSPACE MEDICINE AND BIOLOGY
Jan. 1977 376 p
(NASA-SP-7011(163); Avail: NTIS HC E05 CSCL 06E

This publication is a cumulative index to the abstracts contained in Supplements 151 through 162 of Aerospace Medicine and Biology: A continuing bibliography. It includes three indexes - subject, personal author, and corporate source. Author

N77-28722# Aeronautical Research Council, London (England).
AN ANTHROPOMETRIC SURVEY OF 2,000 ROYAL AIR FORCE AIRCREW, 1970/1971
C. B. Bolton (RAE, Farnborough, Engl.), M. Kenward (Loughborough Univ., Engl.), R. E. Simpson (RAE, Farnborough, Engl.), and G. M. Turner (Royal Air Force Inst. of Aviation Medicine, Farnborough, Engl.) 1975 132 p refs Supersedes RAE-TR-73083 and ARC-35030
(ARC-R/M-3772; RAE-TR-73083; ARC-35030; ISBN-0-11-470917-3) Avail: NTIS HC A07/MF A01; HMSO £6.55; PHI

The survey was undertaken to provide up-to-date information on the body measurements of Royal Air Force aircrew. This information is required for cockpit workspace and functional-clothing-sizing studies. A team of two trained measurers, using a specially designed anthropometric rig, took 62 body measurements of each of 2,000 Royal Air Force aircrew between the ages of 18 and 45 at R.A.F. stations in England. The measurements, are summarized in the form of a percentile table, mean, standard deviation, range and coefficient of variation for each measurement. The statistical summary for each measurement is accompanied by a photograph illustrating the technique of measurement together with a written description of the measuring procedure. The apparatus used is fully described and the organization of the survey is briefly discussed. Author

N77-28723# Aeronautical Research Council, London (England).
AN ANTHROPOMETRIC SURVEY OF 500 ROYAL AIR FORCE AIRCREW HEADS, 1972
P. C. Hobbs (RAE, Farnborough, England) 1975 117 p refs Supersedes RAE-TR-73137 and ARC-35084
(ARC-R/M-3773; RAE-TR-73137; ARC-35084; ISBN-0-11-470918-1) Avail: NTIS HC A06/MF A01; HMSO £7.70; PHI

An anthropometric survey of 500 R.A.F. aircrew heads was undertaken. 45 measurements were taken from each subject. Data obtained from these, together with those from 17 derived measurments are presented in the standard percentile table form. The photogrammetric method used will enable other dimensions, if required at a later date, to be measured from the permanent record photographs without recalling the subject. Author

N77-28724# Medical Coll. of Wisconsin, Milwaukee. Dept. of Microbiology.
STABILIZATION STUDIES ON HUMAN INTERFERON Annual Report, Jun. 1975 - Jun. 1976
Sidney E. Grossberg, J. James Sedmak, Helmut Ankel, Patricia Jameson, and Donald Greiff 1 Mar. 1976 36 p
(Contract AI-4-2520)
(PB-264824/4; IDB-ASP-06-188) Avail: NTIS HC A03/MF A01 CSCL 06M

The stability characteristics were determined for a crude human fibroblast interferon preparation. This crude preparation was very stable to mechanical inactivation even under conditions of vigorous agitation. The crude preparation was quite unstable to heating. Low pH and the addition of chaotropic salts enhanced the thermal stability of this liquid preparation. Freeze-drying provided the preparation most resistant to thermal inactivation. Heat-inactived crude fibroblast interferon could be partially reactivated by increasing the hydrogen-ion concentration in conjunction with carefully selected conditions of heating. GRA

N77-28725# United States Testing Co., Inc., Hoboken, N.J. Biological Services Div.
TOXICOLOGICAL AND SKIN CORROSION TESTING OF SELECTED HAZARDOUS MATERIALS Final Report, 1973-1974
Erskine E. Harton, Jr. and Richard R. Rawl Apr. 1976 32 p refs
(Contract DOT-OST-30077)
(PB-264975/4; DOT-MTB-OHMO-76-2) Avail: NTIS HC A03/MF A01 CSCL 06T

Animal tests were performed using selected substances to determine if they qualified as hazardous materials according to the Department of Transportation Hazardous Materials Regulations. Overall toxicological and skin corrosion test results are summarized. The actual test data and details of the test methods used are also included. GRA

N77-28726# Manned Systems Sciences, Inc., Northridge, Calif.
ASSESSMENT OF A PROTOTYPE HUMAN RESOURCES DATA HANDBOOK FOR SYSTEMS ENGINEERING Final Report, Apr. - Dec. 1976
David Meister Dec. 1976 106 p refs
(Contract F33615-76-C-0045; AF Proj. 1124)
(AD-A039269; AFHRL-TR-76-92) Avail: NTIS HC A06/MF A01 CSCL 05/9

This study assessed the effectiveness, utility and acceptability of a prototype human resources (HR) data handbook developed by the Air Force Human Resources Laboratory (AFHRL-TR-75-64, AD-A019 553). Twelve system development problems (represent-

ative of those the prototype handbook was designed to solve) were simulated in questionnaire form. Thirty-six engineers used the prototype handbook to solve these problems. They also rated problem difficulty level, their confidence in their solutions, the similarity of the problems presented to those they ordinarily dealt with, the usefulness of the prototype handbook, and the adequacy and accessibility of their own data sources compared to the prototype handbook. Results indicated that system development personnel can use the prototype handbook to significantly improve decision correctness. A substantial percentage of respondents considered the prototype handbook to have moderate or greater utility and potential influence on design. Recommendations for improvement of the prototype handbook were made. The assessment is sufficiently encouraging to warrant continuing the effort to develop HR data handbooks. GRA

N77-28727# Michigan Univ., Ann Arbor.
A PSYCHOPHYSICAL ANALYSIS OF COMPLEX INTEGRATED DISPLAYS
Mary Hardzinski and Robert G. Rachella Feb. 1977 59 p refs
(Contract N00014-76-C-0648)
(AD-A039260; Rept-014523-2-T; TR-59) Avail: NTIS HC A04/MF A01 CSCL 05/8

Five types of complex integrated displays were subjected to multidimensional scaling analyses. The display types were selected to be representative of a variety of characteristics that can result when dimensions are combined in an integrated fashion. These characteristics included perceptual separability, familiarity, emergent properties and perceptual interaction among dimensions. Of primary interest was the question of whether or not the Minkowski scaling metric would be diagnostic or predictive of any of these characteristics, as previous literature had indicated. The results showed that in virtually all cases the Euclidean metric produced better fits than the City-Block metric. GRA

N77-28728# Texas Woman's Univ., Denton.
INTERACTION BETWEEN METHYL MERCURY AND RADIATION EFFECTS ON NERVOUS SYSTEMS
Eugene W. Hupp, Dalton Day, James Hardcastle, John Hines, and James Minnich Jan. 1977 133 p refs
(Contract EPA-R-800282)
(PB-265873/0; EPA-600/1-77-006) Avail: NTIS HC A07/MF A01 CSCL 06T

Parameters evaluated included several measurements of behavior, brain electrical activity, lethality, blood-brain barrier permeability, neurotransmitter and mercury concentration in various brain areas, and brain histology. In some cases the effects of the co-insult were less than or at least no greater than at least one of the two insults applied alone. Possible mechanisms of action include opposite effects of the two insults on the blood-brain barrier, with radiation increasing permeability and methyl mercury decreasing it. GRA

N77-28729# Professional Staff Association of the Rancho Los Amigos Hospital, Inc., Downey, Calif.
EFFECTS OF ATMOSPHERIC POLLUTANTS ON HUMAN PHYSIOLOGIC FUNCTION Final Report, 1 Jun. 1971 - Jun. 1976
Jack D. Hackney Jan. 1977 116 p refs
(Grant EPA-R-801396)
(PB-265846/6; EPA-600/1-77-007) Avail: NTIS HC A06/MF A01 CSCL 06P

Short term health effects of common ambient air pollutants, particularly photochemical oxidants, were investigated under controlled conditions simulating typical ambient exposures. Volunteer subjects were exposed, in an environmental control chamber providing highly purified background air, to single pollutants or mixtures under conditions of realistic secondary stress (heat and intermittent exercise). Normal men exposed to ozone (03) showed respiratory symptoms, pulmonary function decrement, and alterations in red cell biochemistry. Subjects with asthma of clinical airway hyperactivity appeared to experience more severe effects of 03 than normals, and subjects chronically exposed to ambient 03 appeared to be less reactive than those living in non 03 polluted areas. GRA

N77-28730# Mayo Foundation, Rochester, Minn.
DEVELOPMENT OF HIGH-RESOLUTION ULTRASONIC IMAGING TECHNIQUES FOR DETECTION AND CLINICAL ASSESSMENT OF CARDIOVASCULAR DISEASE Report for 18 Apr. - 17 Oct. 1976
Titus C. Evans, Jr., Philip S. Green, and James F. Greenleaf 28 Apr. 1977 73 p Prepared in cooperation with Stanford Res. Inst., Menlo Park, Calif.
(Contract N01-HV-4-2904)
(PB-265728/6; NIH-N01-HV-4-2904-3J) Avail: NTIS HC A04/MF A01 CSCL 06B

Ultrasound instrumentation and methods for the detection and assessment of atherosclerosis in carotid and femoral arteries of living patients are tested. Using both laboratory and clinical versions of a high-resolution B-scan and Doppler imaging system, physicians have successfully scanned the carotid arteries on both sides of the neck in 250 patients. Eighteen of the patients imaged with the clinical instrument were also studied by angiography. These cases were studied in a double-bind analysis to check interpretation of the B-scans. Atherosclerotic lesions were readily identified and quantified. Results were comparable to, and sometimes better than, those obtained by using roentgen angiography. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N77-28731# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
INFORMATION PROCESSING OF DOT MATRIX DISPLAYS Final Report, 1 Jun. 1974 - 1 Mar. 1976
Gregory L. Peters and Gregory J. Barbato Oct. 1976 32 p refs
(AF Proj. 2020)
(AD-A036668; AFFDL-TR-76-22) Avail: NTIS HC A03/MF A01 CSCL 05/8

The present studies were designed to assess the performance impact of symbologies composed of discrete elements relative to more conventional continuous symbologies. In an attempt to examine information processing of various components of behavior--such as information input, and central processing and output, three different tasks were selected. A two-or-four alternative choice reaction time task demonstrated an ability to measure a difference between punctate and continuous information, and suggested that the difference is reduced with increased task complexity. A memory search task demonstrated the importance of symbology compatibility, and a display search task revealed equal search efficiencies for punctate and continuous alphanumerics. Additional areas of investigation are discussed. GRA

N77-28732# Honeywell, Inc., Minneapolis, Minn.
COLOR CODING EFFECTS ON HUMAN PERFORMANCE: AN ANNOTATED BIBLIOGRAPHY Final Report
Ellen Barker and Marjorie J. Krebs 1 Apr. 1977 96 p refs
(Contract N00014-76-C-0355)
(AD-A039318; HONEYWELL-77SRC39; ONR-CR-213-136-1F)
Avail: NTIS HC A05/MF A01 CSCL 05/5

Abstracts and references for 78 studies and review articles are provided which are concerned with one or more aspects of color effects on human performance. Major emphasis was placed on including studies of the effect of color as a coding dimension in various tasks. However, articles on a variety of other topics related to the use of color have been included such as: the number of identifiable colors, selection of specific colors, peripheral vision for color, issues of legibility and acuity, etc. In addition, seven reviews of color literature are cited. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N77-28733 Ohio State Univ., Columbus.
SYSTEM MODELING AND SIMULATION: APPLICATION OF A RESEARCH METHODOLOGY AND TEST Ph.D.
Robert George Mills 1976 168 p
Avail: Univ. Microfilms Order No. 77-2462

An approach to modeling and simulating human performance in systems is described. Results indicate that given a known data base, a highly accurate computer simulation could be developed; such that, correlations between its output and the known data base exceeded 0.94, and the verified complete simulation could not accurately simulate team performance when processing input data collected from independent operators. A discussion of the verification process and criteria, implications of test results with respect to methodology and computer simulation modeling and recommendations for future research is presented. Dissert Abstr.

N77-28734# Aeronautical Research Council, London (England).
THE DEVELOPMENT OF PORTABLE COOLERS FOR THE LIQUID CONDITIONED SUIT
G. F. Barlow (RAE, Farnborough, England) 1975 35 p refs Supersedes RAE-TR-74114 and ARC-35793
(ARC-CP-1330; RAE-TR-74114; ARC-35793; ISBN-011-470940-8) Avail: NTIS HC A03/MF A01; HMSO £1.60; PHI

Two portable coolers for use with liquid conditioned suits have been designed and developed; one using solid carbon dioxide as the heat sink and the other water-ice. They provide 250 W h of cooling at rates up to 350 W with outlet temperatures of 12 C and 20 C respectively; their weights are 5.8 kg and 4.6 kg. The water-ice cooler can be recharged without replacing the water or battery by connecting it to a recharging unit which has been designed. This greatly reduces the handling problems normally associated with portable coolers. The results of laboratory and field trials in ambient temperatures up to 40 C are presented, with recommendations for further development. Author

N77-28735# Aeronautical Research Council, London (England).
SPECIMEN SIZE-ROLLS FOR AIRCREW HEADGEAR BASED ON AN ANALYSIS OF THE HEAD MEASUREMENTS OF 2000 ROYAL AIR FORCE AIRCREW
R. E. Simpson (RAE, Farnborough, England) 1975 110 p refs Supersedes RAE-TR-74072 and ARC-35666
(ARC-R/M-3774; RAE-TR-74072; ARC-35666; ISBN-0-11-470919-X) Avail: NTIS HC A06/MF A01; HMSO £6.50; PHI

The head measurements have been processed to provide size-roll data in a form suitable for use by headgear designers. Specimen size-rolls are presented based on sizing control measurements thought likely to meet the requirements of the headgear designer. The logistic need for a minimum number of sizes of the end product has been the major criterion in the selection of control measurement range intervals; the acceptability of the intervals or sizing steps chosen will need to be proved for specific designs of headgear. Selection of the most appropriate sizing control measurement(s) by the designer will be influenced by many factors depending on the type of headgear, critical fit measurements, etc. Some guidance on control measurement selection is provided in the discussion of the results of the various approaches outlined. Author

N77-28736*# Life Systems, Inc., Cleveland, Ohio.
TECHNOLOGY ADVANCEMENT OF THE ELECTROCHEMICAL CO2 CONCENTRATING PROCESS Annual Report, Feb. 1975 - Mar. 1977
F. H. Schubert, R. R. Woods, T. M. Hallick, and D. B. Heppwer May 1977 75 p refs
(Contract NAS2-8666)
(NASA-CR-151995; LSI-ER-258-10) Avail: NTIS HC A04/MF A01 CSCL 06K

A five-cell, liquid-cooled advanced electrochemical depolarized carbon dioxide concentrator module was fabricated. The cells utilized the advanced, lightweight, plated anode current collector concept and internal liquid-cooling. The five cell module was designed to meet the carbon dioxide removal requirements of one man and was assembled using plexiglass endplates. This one-man module was tested as part of an integrated oxygen generation and recovery subsystem. Author

N77-28737# Horizons Research, Inc., Cleveland, Ohio.
SCREENING STUDY TO IDENTIFY PHASE CHANGE COOLANTS FOR PORTABLE LIFE SUPPORT SYSTEMS Final Report, Jun. - Dec. 1976
Sandra S. Donovan Feb. 1977 72 p refs
(Contract N00140-76-C-6703)
(AD-A038504; P-385; NCTRF-TR-124) Avail: NTIS HC A04/MF A01 CSCL 06/11

A literature search to identify coolant candidates to be considered for replacing the ice-water system in a portable life support unit led to the following considerations: CO2, an NH3-CO2 mixture, and a salt such as potassium acid fluoride incorporated into ice. In the CO2 system, solid CO2 will sublimate and the resultant gases warm to 4 C, then be expelled from the suit. The heat absorption for this process is 153.0 Kcal/kg. To achieve 504 Kcal (2000 Btu) of cooling, 3.3 Kg (7.3 lbs) of CO2 is needed. This is an 83% improvement over the heat absorption of ice melting and warming to 4 C, or a 45% reduction in the weight of ice needed. The CO2 system appears to be completely safe. In the NH3-CO2 system, the CO2 will sublimate, the NH3 vaporize, and the resultant gases warm to 4 C, then with mixing be expelled from the suit. This system might be flammable, so should be examined in the laboratory. The heat absorption for this system is an impressive 198.5 Kcal/kg for an 0.8 mole ratio of NH3 to CO2. To achieve 504 Kcal (2000 Btu) of cooling, 2.5 Kg (5.6 lbs) of total coolant is needed. This is a 137% improvement over the heat absorption of ice melting and warming to 4 C, or a 58% reduction in the weight of ice needed. In the potassium acid fluoride-ice system, the heat of solution of the salt is added to the heat of fusion of ice. Over the temperature range of about -15 to 5 C, this system yield 121 Kcal/kg. To achieve 504 Kcal (2000 Btu) of cooling, 4.12 Kg (9.2 lbs) of total coolant is needed. This is a 45% improvement over the ice alone system. GRA

N77-28738# Purdue Univ., Lafayette, Ind. Purdue Lab. for Applied Industrial Control.
A UNIT TASK SIMULATOR FOR THE EVALUATION OF INTERACTIVE MAN-COMPUTER SYSTEMS M.S. Thesis
Edwin C. Alford and James R. Buck Dec. 1976 225 p refs
(Grant NSF APR-73-07822)
(PB-265097/6; NSF/RA-760457) Avail: NTIS HC A10/MF A01 CSCL 13H

The UTS (Unit Task Simulator) methodology was developed to assist the systems analyst in modelling the proposed interactive process or production control systems so that he could obtain data for use in evaluating and improving these systems. The UTS program allows simulation activities to be timed to occur in units of real time, and, therefore, the collected data accurately describes the behavior of the man and the process throughout the simulation. A survey of literature relevant to the analysis of man-computer systems is provided. GRA

N77-28739# Swedish Council for Building Research, Stockholm.
IMPACT LOADS PRODUCED BY HUMAN MOTION. PART 1: BACKROUND AND EXPERIMENTAL INVESTIGATION
Leif Nilsson 1976 211 p refs
(PB-264950/7; D13:1976; ISBN-91-540-2619-9) Avail: NTIS HC A10/MF A01 CSCL 13M

The research project falls into two main phases, a first one devoted to experimental investigation of some impact loads and their respective actions and a second one dealing with the definition of relevant performance requirements. The experimental part includes the measuring of dynamic effects which may be produced by human motion when striking various structural members. The results obtained are applicable to the values used when dimensioning e.g. slabs, stairs, walls, balcony parapets, rails, roofs etc. GRA

N77-28740# University of Southern Calif., Los Angeles. Inst. of Safety and Systems Management.

RESTRAINT SYSTEMS EVALUATION PROGRAM Final Report, Jun. 1974 - Jan. 1976

J. Baird, F. Sublett, R. Hughes, J. Didion, and J. Stoddard Feb. 1977 271 p refs

(Contract DOT-HS-010-1-176)

(PB-265562/9; USC-75; DOT-HS-802-286) Avail: NTIS HC A12/MF A01 CSCL 13F

Level 2 and Level 3 techniques of accident investigation were utilized. During the period of the study, 2,853 accidents were investigated using the Level 2 technique. An additional 29 collisions were studied under the Level 3, multidisciplinary technique. Four of the 29 collisions involved vehicles equipped with the Air Cushion Restraint System (ACRS). The four ACRS collisions occurred: 2 in California, 1 in Washington, and 1 in Wyoming. Three of the four ACRS cases involved ACRS deployment that functioned within design limits. The remaining 25 Level 3 cases and all Level 2 investigations were conducted in the cities of Los Angeles and Culver City, California. The Level 2 investigations revealed that 43% of the occupants of the vehicles studied utilized the restraint systems (lap and torso belts) available. Approximately 46% of the drivers and 36% of the right-front-passengers utilized the available restraints. GRA

N77-28741# School of Aerospace Medicine, Brooks AFB, Tex.

EVALUATION OF V-51 AND EAR (TRADEMARK) EAR-PLUGS FOR USE IN FLIGHT Final Report, 1 Jan. - 30 May 1976

Roger L. Stork and Donald C. Gasaway Feb. 1977 8 p

(AF Proj. 7930)

(AD-A038414; SAM-TR-77-1) Avail: NTIS HC A02/MF A01 CSCL 06/17

This study evaluated the test plugs for short-term comfort, ease of use, and their ability to allow pressure equalization in the external auditory canal during both ascent and descent. This study did not attempt to evaluate attenuation features of either earplug. Approximately half the test subjects thought the V-51 R earplugs were more comfortable than the EAR (trademark) plugs. All 30 test subjects indicated that the EAR (trademark) plugs were more difficult to use than the V-51 R plugs. All subjects completed the altitude flight series without ear pain or discomfort due to the changing barometric pressure. This study suggests that the majority of our aircrews could wear either earplug in flight without difficulty, thus providing increased protection against the hazardous noise environments in which the aircrews must perform. Author (GRA)

N77-28742# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Vision.

OPTICAL PROPERTIES AND VISUAL EFFECTS OF FACE MASKS

1977 11 p

(Contract N00014-75-C-0406)

(AD-A038197) Avail: NTIS HC A02/MF A01 CSCL 06/17

Working Group 48 was specifically asked to suggest procedures for studying the optical properties and visual effects of the XM-29 mask, and this report is based on material presented and discussed at Ft. Rucker on July 14-15, 1976. However, the techniques of field and laboratory testing described in the report may be generally used to study a variety of face masks. The XM-29 field protective mask is designed for military use to provide respiratory protection against field concentrations of all chemical and biological agents in vapor or aerosol form. GRA

N77-28743# Michigan Univ., Ann Arbor. Human Performance Center.

INTELLECTUAL PERFORMANCE UNDER STRESS Final Report, 1 Oct. 1971 - 30 Jun. 1976

Robert G. Pachella Sep. 1976 57 p refs

(Contract F44620-72-C-0019; ARPA Order 1949)

(AD-A038196; AFOSR-77-0313TR; Rept-010588-34-F) Avail: NTIS HC A04/MF A01 CSCL 05/10

This contract continued research programs funded from 1 June 1963 under contracts AF 49(638)-1235 and AF 49(638)-1736. One of the general objectives was to establish a permanent research facility for the investigation of human performance capabilities and limitations that are of importance for the performance of men in a wide variety of man-machine systems. The effort within the present contract program has been directed more and more to the perceiving and remembering functions, with increasingly heavy emphasis on cognitive and intellectual factors and skills. GRA

N77-28744# Army Aeromedical Research Lab., Fort Rucker, Ala.

MASS SPECTROSCOPIC ANALYSIS OF POLYETHER AND POLYURETHANE FOAM PLASTICS DEGENERATION IN THE SPH-4 HELMET Final Report

Roderick J. McNeil and Frank S. Pettyjohn Oct. 1976 11 p

(AD-A036447; USAARL-77-1) Avail: NTIS HC A02/MF A01 CSCL 06/17

Two components of plastic manufacture, n-butyl-phthalate and ethyl-methyl ketone, have been found in high concentrations contained in the low gaseous transfer coefficient polyethylene protective bag for the SPH-4 aviator helmet. These agents are the cause of the deterioration of the SPH-4 helmet polyether and polyurethane foam lining material. The use of mass spectrographic and gas chromatographic techniques provided the sampling of chemical compounds contained within the polyethylene bag. The solution to prevent foam liner deterioration is to remove the SPH-4 helmet from the protective bag. Author (GRA)

N77-28745# Desmatics, Inc., State College, Pa.

A STATISTICAL STUDY OF GRAB SAMPLING IN A CLOSED ENVIRONMENT

Dennis E. Smith and Terry L. King Feb. 1977 52 p

(Contract N00014-75-C-1054)

(AD-A036666; TR-106-4) Avail: NTIS HC A04/MF A01 CSCL 06/11

Maintaining the quality of an enclosed environment (e.g., aboard a submarine) requires monitoring of the environment by means of sampling procedures. One general type of sampling procedure is 'grab sampling', in which atmospheric samples are obtained, essentially instantaneously, in evacuated flasks. This report describes an experiment to determine (1) whether differences exist in the performance of four grab sampling methods, and (2) whether a delay in analyzing the samples affects the results (i.e., whether the samples have a shelf life). Eleven contaminants, each at a high and a low concentration level, were used in the study. Grab samples of these contaminants were analyzed at ten day intervals from the time sampling occurred until seventy days had elapsed. Although the experiment did not reveal differences in grab sampling methods, it did indicate that, for most of the contaminants, the samples do have a shelf life. Author (GRA)

N77-28746# Webb Associates, Yellow Springs, Ohio.

EFFECTS OF ENCUMBERING CLOTHING, PERSONAL-PROTECTIVE EQUIPMENT AND RESTRAINTS ON BODY SIZE AND ARM-REACH CAPABILITY OF USAF AIRCREWMEN

Milton Alexander (AMRL), Lloyd L. Laubach, and John T. McConville May 1976 4 p refs Presented at the Aerospace Med. Assoc. Meeting, Bal. Harbour, Fla., 10-13 May 1976

(Contract F33615-76-C-5007; AF Proj. 7184)

(AD-A036682; AMRL-TR-76-118) Avail: NTIS HC A02/MF A01 CSCL 06/14

Basic anthropometric dimensions provide engineers and designers with data on the range of body size variability that must be accommodated in the design and development of clothing, personal-protective equipment and workspaces. Designers of cockpits and similar workspaces must also be cognizant of the growth in body size associated with various configurations of clothing and personal-protective equipment and the effects of these assemblies on performance of the users. A study of a stratified sample of 32 USAF pilots wearing their operational assemblages of over-land and over-water flight gear and equipment was conducted. The study determined changes in critical workspace dimensions and arm and leg reach performance due to encumberments of the clothing and equipment. The results of the investigation indicated changes occurred both in body size and performance which were of significance to designers. Author (GRA)

N77-28747# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

A PHASE PLANE APPROACH TO STUDY THE ADAPTIVE NATURE OF A HUMAN PERFORMING A TRACKING TASK

D. W. Repperger, W. C. Summers, E. J. Hartzell, and G. D. Callin Dec. 1976 5 p

(AD-A036223; AMRL-TR-76-95) Avail: NTIS HC A02/MF A01 CSCL 05/8

One of the most complex and adaptive systems to study is a human involved in a closed loop tracking task. It is observed that when the forcing function of the closed loop system has a time varying velocity and acceleration profile, the human will track the input until it exceeds his physical (visual) limitation. When the input is changing too fast for the human to follow, adaptation (or regression) from tracking occurs. If, however, the input is not changing too rapidly, the human will reacquire the target and continue tracking. A study of this type of adaptability is considered here using the phase plane with a statistical analysis performed over a family of four input forcing functions. Author (GRA)

N77-28748# Calspan Corp., Buffalo, N. Y.

E-2 C SYSTEMS APPROACH TO TRAINING. PHASE 1 Final Report, Apr. 1975 - Jun. 1976

Robert C. Sugarman, Steven L. Johnson, John F. Mitchell, William M. Hinton, Jr., and Robert P. Fishburne, Jr. Dec. 1976 137 p (Contract N61339-75-C-01)

(AD-A036264; NAVTRAEQUIPC-75-C-0101-1) Avail: NTIS HC A03/MF A01 CSCL 05/9

A revision of the instructional system for the E-2C was developed to enhance the cost-effectiveness of the training. The five-man E-2C crew consists of a pilot, copilot, combat information center officer (CICO), air control officer (ACO), and flight technician (FT), with training for these positions being conducted at RVAW-120, Norfolk Naval Air Station. This project followed the principles of Instructional Systems Design (ISD). After completing a task analysis for each position, the analysts prepared (in sequence) behavioral objectives, training support (media) requirements and lesson specifications. To support the effort, information was collected relevant to entry level behavior of trainees, existing resources available, and external influences (constraints) that affect the training system. The proposed syllabi incorporate a shift in emphasis toward: earlier 'hands-on' training, modified self-paced (individualized) instruction for most of the academic lessons; and a comprehensive plan for criterion-referenced performance assessment throughout the progression of cognitive (i.e., academic), practice, and sortie/scenario lessons. After the implementation and validation process is carried out in Phase 2, it is expected that significant reductions in training costs will be achieved through a shorter total course length, a greater proportion of synthetic training relative to in-flight practice, and a quality control program. Data provided will allow evaluation of the methodology, definition of the constraints and operating conditions that impact on aircrew training, and acquisition of cost, scheduling and manpower data for future ISD planning. Author (GRA)

N77-28749# Naval Medical Research Inst., Bethesda, Md.

HUMAN FACTORS AND DIVING EQUIPMENT DESIGN Progress Report

Arthur J. Bachrach 1977 11 p refs Proc. of 3d Joint Meeting of the Panel on Diving Physiol. and Technol., The United States-Japan Conf. on Develop. and Util. of Nat. Resources, (UJNR), Tokyo, 18-19 Jul. 1975

(AD-A040110) Avail: NTIS HC A02/MF A01 CSCL 05/5

For too long divers have been asked to compensate for inadequately designed equipment. In recent years, the Behavioral Sciences Dept at this institute--in cooperation with the Navy Experimental Diving Unit and the Performance Physiology Lab. of the University of California at Los Angeles--has engaged in a series of human engineering studies in diving. A combination of physiological measures, biomechanical dynamic anthropometric measures, and underwater performance assessment appears to provide the most efficient way of approaching diver performance. The physiological cost of the equipment, the impact of the equipment on the diver's performance, and the diver's ability to work under varying environmental conditions still needs considerable research investigation. In this report the human bioengineering and performance physiology techniques outlined above are discussed; recommendations are made for further systematic cooperative research with other laboratories. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N77-28750*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PROCEEDINGS OF THE 1977 MACSYMA USERS' CONFERENCE

1977 596 p Conf. held at Calif. Univ., Berkeley, 27 - 29 Jul. 1977; sponsored by NASA, MIT and Calif. Univ., Berkeley

(NASA-CP-2012) Avail: NTIS HC A25/MF A01 CSCL 09B

The MACSYMA program for symbolic and algebraic manipulation enables exact, symbolic mathematical computations to be performed on a computer. This program is rather large, and various approaches to the hardware and software problems are examined. For individual titles, see N77-28751 through N77-28792.

N77-28751*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.

MACSYMA'S SYMBOLIC ORDINARY DIFFERENTIAL EQUATION SOLVER

Jeffrey P. Golden *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 1-10 refs (For primary document see N77-28750 19-64)

(Grant NsG-1323; Contract E(11-1)-3070)

Avail: NTIS HC A25/MF A01 CSCL 12A

The MACSYMA's symbolic ordinary differential equation solver ODE2 is described. The code for this routine is delineated, which is of interest because it is written in top-level MACSYMA language, and may serve as a good example of programming in that language. Other symbolic ordinary differential equation solvers are mentioned. Author

N77-28752*# Hawaii Univ., Honolulu.

A PROGRAM FOR THE SOLUTION OF INTEGRAL EQUATIONS **c64**

Richard A. Bogen *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 11-19 refs (For primary document see N77-28750 19-59)

(Grant NSF MC-575-22983)

Avail: NTIS HC A25/MF A01 CSCL 12A

The program, first written in REDUCE, was implemented in MACSYMA with several additional techniques which are explained. By utilizing many methods, the program can obtain closed-form and series solutions to a large class of linear and nonlinear problems. One of the techniques developed, reduction to a differential equation, has not previously appeared in the literature in the general form described. Author

N77-28753*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.

SYMBOLIC LAPLACE TRANSFORMS OF SPECIAL FUNCTIONS **c64**

Yannis Avgoustis *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 21-41 refs (For primary document see N77-28750 19-59)

(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 12A

A MACSYMA implementation of the Laplace transform for special functions is described. The generalized hypergeometric functions are used as a basis for the representation of approximately fifty special functions. Only a relatively small number of formulas that generally involve generalized hypergeometric functions are utilized for the integration stage. A sample of actual examples and their timing is provided. Author

N77-28754*# California Univ., Berkeley.
AN IMPROVED ALGORITHM FOR THE ISOLATION OF POLYNOMIAL REAL ZEROS **c64**
Richard J. Fateman *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 43-54 refs (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 12A

THe Collins-Loos algorithm for computing isolating intervals for the zeros of an integer polynomial requires the evaluation of polynomials at rational points. This implies the use of arbitrary precision integer arithmetic. It is shown how careful use of single precision, floating point arithmetic within the context of a slightly modified algorithm can make the calculation considerably faster and no less exact. Typically, 95% or more of the evaluations can be done without exact arithmetic. The precise speedup depends on the relative costs of the arithmetic in a given implementation. The implementation on DEC KL-10 computer is some 5 to 10 times faster than the original Univac 1110 implementation in SAC-I. Author

N77-28755*# Massachusetts Inst. of Tech., Cambridge. Lab. of Computer Science.
PRESERVING SPARSENESS IN MULTIVARIATE POLYNOMINAL FACTORIZATION **c64**
Paul S. Wang *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 25-64 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 12A

Attempts were made to factor these ten polynomials on MACSYMA. However it did not get very far with any of the larger polynomials. At that time, MACSYMA used an algorithm created by Wang and Rothschild. This factoring algorithm was also implemented for the symbolic manipulation system, SCRATCHPAD of IBM. A closer look at this old factoring algorithm revealed three problem areas, each of which contribute to losing sparseness and intermediate expression growth. This study led to effective ways of avoiding these problems and actually to a new factoring algorithm. The three problems are known as the extraneous factor problem, the leading coefficient problem, and the bad zero problem. These problems are examined separately. Their causes and effects are set forth in detail; the ways to avoid or lessen these problems are described. Author

N77-28756*# IBM Watson Research Center, Yorktown Heights, N.Y. Mathematical Sciences Dept.
ON THE EQUIVALENCE OF POLYNOMIAL GCD AND SQUAREFREE FACTORIZATION PROBLEMS **c64**
David Y. Y. Yun *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 65-70 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 12A

It is shown that a closer reexamination of Yun's 1976 paper reveals the reducibility of SQFR to GCD. The natural question that follows is whether GCD is reducible to SQFR. That is answered affirmatively and the derivation actually suggests an algorithm for computing GCD's when input polynomials are already represented by their SQFR form. Author

N77-28757*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIFFERENTIAL FORM ANALYSIS USING MACSYMA **c64**
Hugo D. Wahlquist *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 71-74 refs (For primary document see N77-28750 19-59)
(Contract NAS7-100)
Avail: NTIS HC A25/MF A01 CSCL 12A

The MACSYMA file was written to perform these operations and discusses the improvements and additions which are needed to accomplish a complete and efficient implementation. Examples of differential form calculations are displayed. Author

N77-28758*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
INDICATOR TENSOR MANIPULATION ON MACSYMA **c62**
Richard A. Bogen and Richard Pavelle (Logicon, Inc., Lexington, Mass.) *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 75-85 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 09B

A new computational tool for physical calculations is described. It is the first computer system capable of performing indicial tensor calculus (as opposed to component tensor calculus). It is now operational on the symbolic manipulation system MACSYMA. The capabilities of the system are outlined. Author

N77-28759*# Naval Research Lab., Washington, D. C.
PURE FIELD THEORIES AND MACSYMA ALGORITHMS **c61**
William S. Ament *in* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 87-96 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 09B

A pure field theory attempts to describe physical phenomena through singularity-free solutions of field equations resulting from an action principle. The physics goes into forming the action principle and interpreting specific results. Algorithms for the intervening mathematical steps are sketched. Vacuum general relativity is a pure field theory, serving as model and providing checks for generalizations. The fields of general relativity are the 10 components of a symmetric Riemannian metric tensor; those of the Einstein-Straus generalization are the 16 components of a nonsymmetric. Algebraic properties are exploited in top level MACSYMA commands toward performing some of the algorithms of that generalization. The light cone for the theory as left by Einstein and Straus is found and simplifications of that theory are discussed. Author

N77-28760*# Western Kentucky Univ., Bowling Green. Dept. of Physics and Astronomy.
BLACK HOLES AND RELATIVITIC GRAVITY THEORIES **c89**
A. J. Fennelly and Richard Pavelle (Logicon, Lexington, Mass.) *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 97-107 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 03A

All presently known relativistic gravitation theories were considered which have a Riemannian background geometry and possess exact static, spherically symmetric solutions which are asymptotically flat. Each theory predicts the existence of trapped surfaces (black holes). For a general static isotropic metric, MACSYMA was used to compute the Newman-Penrose equations, the black hole radius, the impact parameter, and capture radius for photon accretion. These results were then applied to several of the better known gravitation theories. Author

N77-28761*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
THE EVALUATION OF ATOMIC VARIABLES IN MACSYMA **c61**
Jeffrey P. Golden *In* NASA. Langley Res. Center Proc. of 1977 MACSYMA Users' Conf. 1977 p 109-122 refs (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 09B

Evaluation free expressions, implicit and explicit assignment, and evaluation of MACSYMA are outlined. MACSYMA options, EV command, single level evaluation, and multilevel evaluation are also considered. J.A.M.

N77-28762*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
THE VARIETY OF VARIABLES IN MATHEMATICAL EXPRESSIONS **c64**
Joel Moses *In* NASA. Langley Res. Center Pro. of the 1977

MACSYMA Users' Conf. 1977 p 123-144 (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 12A

Various distinctions are discussed which can be made regarding evaluation of mathematical expressions: regular evaluation vs. infinite evaluation vs. finite evaluation, regular variables vs. mathematical variables vs. shadow variables vs. labels, simplification vs. evaluation vs. solution of equations. The unsatisfactory state of evaluation strategies in symbolic systems is due to insufficient use of such distinctions in the past. Author

N77-28763*# Naval Ship Research and Development Center, Annapolis, Md.
RATIONAL APPROXIMATION TO e TO THE -x POWER WITH NEGATIVE POLES c64
Elizabeth Cuthill *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 131-144 refs (For primary document see N77-28750 19-59)
HC A25/MF A01 CSCL 12A

MACSYMA was applied to the generation of an expansion in terms of Laguerre polynomials to obtain approximations to e to the -x power on [0, infinity]. These approximations are compared with those developed by Saff, Schonhage, and Varga. Author

N77-28764*# College of William and Mary, Williamsburg, Va.
TIMING FORMULAS FOR DISSECTION ALGORITHMS ON VECTOR COMPUTERS c64
W. G. Poole, Jr. *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 145-150 refs (For primary document see N77-28750 19-59)
(Contracts NAS1-14101; N00014-75-C-0879)
Avail: NTIS HC A25/MF A01 CSCL 12A

The use of the finite element and finite difference methods often leads to the problem of solving large, sparse, positive definite systems of linear equations. MACSYMA plays a major role in the generation of formulas representing the time required for execution of the dissection algorithms. The use of MACSYMA in the generation of those formulas is described. Author

N77-28765*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SYMBOLIC CALCULATIONS IN A FINITE DYNAMIC ELEMENT ANALYSIS c64
Kajal K. Gupta and Edward W. Ng *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 151-159 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 12A

A second order problem is outlined for which MACSYMA was used only for checking purpose. A fourth order problem is briefly described for which a symbolic system is necessary. At the end, some sample output is displayed to indicate the complexity of the computational problem. Author

N77-28766*# College of William and Mary, Williamsburg, Va.
SYMBOLIC MANIPULATION TECHNIQUES FOR VIBRATION ANALYSIS OF LAMINATED ELLIPTIC PLATES c39
C. M. Andersen and Ahmed K. Noor (George Washington Univ., Washington, DC) *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 161-175 refs Sponsored by NASA Langley Res. Center (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 20K

A computational scheme is presented for the free vibration analysis of laminated composite elliptic plates. The scheme is based on Hamilton's principle, the Rayleigh-Ritz technique and symmetry considerations and is implemented with the aid of the MACSYMA symbolic manipulation system. The MACYSMA system, through differentiation, integration, and simplification of analytic expressions, produces highly-efficient FORTRAN code for the evaluation of the stiffness and mass coefficients. Multiple use is made of this code to obtain not only the frequencies and mode shapes of the plate, but also the derivatives of the frequencies with respect to various material and geometric parameters. Author

N77-28767*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OBSERVATIONS ON APPROXIMATE INTEGRATIONS c64
Edward W. Ng *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 177-180 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 12A

A class of integration strategies is explored that fall in between the two extremes of symbolic integration and numerical quadrature, which are, respectively, aimed at the computer generation of answers in the form of exact expressions and numerical values. The theoretical advances in symbolic integration are discussed. Three major contexts of applications with attendant case studies, four possible types of strategies for approximate integration are examined. The feasibility and adequacy (or inadequancy) of MACSYMA for implementing these strategies are considered. Author

N77-28768*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
LISP: PROGRAM IS DATA. A HISTORICAL PERSPECTIVE ON MACLISP c16
Jon L. White *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 181-189 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 09B

There was a continuing development of the MACLISP system, spurred in great measure by the needs of MACSYMA development. In a mosaic, historical style, the major features of the system are reported. For each feature discussed, an attempt is made to mention the year of initial development, and the names of persons or projects primarily responsible for requiring, needing, or suggesting such features. Author

N77-28769*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
LISP: DATA IS PROGRAM. A TUTORIAL IN LISP c61
Jon L. White *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 191-202 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 09B

A novel approach at teaching LISP to a novice was developed. The abstract data format is presented, emphasizing its real structure and its machine implantation. Then the technique of writing programs in the data language, and of interpreting them, is presented. Illustrative features are drawn from various extant LISP implementations. Author

N77-28770*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
DATA REPRESENTATIONS IN PDP-10 MACLISP c61
Guy Lewis Steele, Jr. *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 203-214 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 09B

The internal representations of the various MacLISP data types are presented and discussed. Certain implementation tradeoffs are considered. The ultimate decisions on these tradeoffs are discussed in the light of MacLISP's prime objective of being an efficient high-level language for the implementation of large systems such as MACSYMA. The basic strategy of garbage collection is outlined, with reference to the specific representations involved. Certain clever tricks are explained and justified. The address space crunch is explained and some alternative solutions explored. Author

N77-28771*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
FAST ARITHMETIC IN MACLISP c61
Guy Lewis Steele, Jr. *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 215-224 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 09B

MacLISP provides a compiler which produces numerical code competitive in speed with some FORTRAN implementations and yet compatible with the rest of the MacLISP system. All numerical programs can be run under the MacLISP interpreter. Additional declarations to the compiler specify type information which allows the generation of optimized numerical code which generally does not require the garbage collection of temporary numerical results. Array accesses are almost as fast as in FORTRAN, and permit the use of dynamically allocated arrays of varying dimensions.

The implementation decisions regarding user interface, data representations, and interfacing conventions are discussed which allow the generation of fast numerical LISP code. Author

N77-28772*# Toronto Univ. (Ontario). Div. of Physical Sciences.

ON COMPUTING CLOSED FORMS FOR SUMMATIONS **c64**

Robert Moenck *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 225-236 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 12A

The problem of finding closed forms for a summation involving polynomials and rational functions is considered. A method closely related to Hermite's method for integration of rational functions derived. The method expresses the sum of a rational function as a rational function part and a transcendental part involving derivatives of the gamma function. Author

N77-28773*# Xerox Corp., Palo Alto, Calif. Air Research Center.

INDEFINITE HYPERGEOMETRIC SUMS IN MACSYMA **c64**

R. Wm. Gosper, Jr. *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 237-251 refs Sponsored in part by NSF (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 12A

A MACSYMA function is presented which, given the command a sub n = delta g(n) = g(n+1)-g(n), finds g(n), the indefinite sum, within an additive constant, provided that g(n+1)/g(n) is a rational function of n. Author

N77-28774*# Rensselaer Polytechnic Inst., Troy, N. Y.

MODULAR POLYNOMIAL ARITHMETIC IN PARTIAL FRACTION DECOMPOSITION **c64**

S. K. Abdali, B. F. Caviness, and A. Pridor *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 253-261 refs (For primary document see N77-28750 19-59)
(Grant NSF MCS-76-23762)
Avail: NTIS HC A35/MF A01 CSCL 12A

Algorithms for general partial fraction decomposition are obtained by using modular polynomial arithmetic. An algorithm is presented to compute inverses modulo a power of a polynomial in terms of inverses modulo that polynomial. This algorithm is used to make an improvement in the Kung-Tong partial fraction decomposition algorithm. Author

N77-28775*# Universidad Boliviana Mayor de San Simon, Cochabamba.

A NEW ALGORITHM FOR THE INTEGRATION OF EXPONENTIAL AND LOGARITHMIC FUNCTIONS **c64**

Michael Rothstein *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 263-274 refs (For primary document see N77-28750 19-59)
(Grants NSF MCS-76-23762; NSF-GU-32181; NSF MCS-76-15035)
Avail: NTIS HC A25/MF A01 CSCL 12A

An algorithm for symbolic integration of functions built up from the rational functions by repeatedly applying either the exponential or logarithm functions is discussed. This algorithm does not require polynomial factorization nor partial fraction decomposition and requires solutions of linear systems with only a small number of unknowns. It is proven that if this algorithm is applied to rational functions over the integers, a computing time bound for the algorithm can be obtained which is a polynomial in a bound on the integer length of the coefficients, and in the degrees of the numerator and denominator of the rational function involved. Author

N77-28776*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.

USER AIDS FOR MACSYMA **c62**

V. Ellen Lewis *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 275-290 ref (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 09B

The aids available to the MACSYMA user are described from the printed manual, primer, and system introduction to the various on-line sources of help. Included are directions for making inquiries about user-defined functions and variables. Author

N77-28777*# Harvard Univ., Cambridge, Mass. Center for Research in Computing Technology.

THE DIFFICULTIES OF USING MACSYMA AND THE FUNCTION OF USER AIDS **c62**

Michael R. Genesereth *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 291-308 refs Prepared in cooperation with MIT, Cambridge (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 09B

The size and complexity of the MACSYMA system may create learning difficulties for users. Deficiency in understanding the system leads to resource knowledge difficulties. A communication factor arises from a difference between the primitive objects, actions, and relations of a user's problem and those provided by the system. The functions of various user aids in handling each of these difficulties are discussed. Author

N77-28778*# Harvard Univ., Cambridge, Mass. Center for Research in Computing Technology.

AN AUTOMATED CONSULTANT FOR MACSYMA **c61**

Michael R. Genesereth *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 309-313 To be presented at 5th Intern. Joint Conf. on Artificial Intelligence Prepared in cooperation with MIT, Cambridge (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 09B

A consultant is necessary whenever on is faced with a problem solving situation in a domain one does not fully understand. The lack of knowledge may be incidental, as it is when the domain or device is fairly simple but time constraints make it impossible for the user to learn all that is necessary. Computer systems like MACSYMA in which the level of commands is so close to the level of the task environment that the user is apt to confuse a simply defined procedure (like COEFF) with its mathematical counterpart (here coefficient) that it at best approximates. A computer program is described which has the capability of conversing with its user in English about a difficulty he has encountered, and providing information tailored to his need. The MACSYMA Advisor is a program distinct from MACSYMA with its own separate data base and expertise. For convenience the program can be called directly from MACSYMA and can access the user's data structures contained therein. The Advisor described here deals only with the 'straightline' or nested use of MACSYMA commands and not loops or user-defined functions. The implementation of the Advisor relies heavily on an explict, internal 'model' of the user's state of knowledge, his goals, and his 'plan' for achieving them. Author

N77-28779*# California Univ., Berkeley.

SOME MACSYMA PROGRAM FOR SOLVING DIFFERENCE EQUATIONS **c61**

John Ivie *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 317-326 refs Submitted for publication (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 09B

A set of MACSYMA programs are described for finding closed form solutions to linear recurrence relations in equations having either constant or variable coefficients. In the homogenous case, a polymonial equation is obtained and the solution to the recurrence relation can be written as a linear combination of the roots of the polynomial. Exponential generating functions are used to solve variable coefficient relations. Taking successive derivatives and using the recurrence relation, an ordinary differential equation is obtained. Expanding the solution to the differential equation in a Taylor series, shows that the nth term of the series is the solution to the recurrence relation. For second order recurrences, a check is made for those that can be solved in terms of Bessel functions. Author

N77-28780*# California Univ., Berkeley.
SOME COMMENTS ON SERIES SOLUTIONS c64
Richard J. Fateman *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p327-346 refs (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 12A

The use of power series and truncated power series in the MACSYMA system for algebraic manipulation is illustrated. Algebraic and differential equations are solved using Taylor series or asymptotic series. Deficiencies of the current scheme are noted, and remedies suggested. Author

N77-28781*# Mitre Corp., Bedford, Mass.
POWER SERIES SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS IN MACSYMA c64
Edward L. Lafferty *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 347-360 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 12A

A program is described which extends the differential equation solving capability of MACSYMA to power series solutions and is available via the SHARE library. The program is directed toward those classes of equations with variable coefficients (in particular, those with singularities) and uses the method of Frobenius. Probably the most important distinction between this package and others currently available or being developed is that, wherever possible, this program will attempt to provide a complete solution to the equation rather than an approximation, i.e., a finite number of terms. This solution will take the form of a sum of infinite series. Author

N77-28782*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
RADICAL SIMPLIFICATION MADE EASY c64
Richard E. B. Zippel *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 361-367 refs (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 12A

Problems encountered in manipulating algebraic numbers and functions are discussed. Methods for simplifying nested and un-nested radicals are described. Results obtained are either classical or direct corollaries of classical results. Author

N77-28783*# Massachusetts Inst. of Tech., Cambridge.
A CONSTRUCTIVE APPROACH TO COMMUTATIVE RING THEORY c67
David A. Spear *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 369-376 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 12A

The development of a system in MACSYMA for solving ring problems is described. Fundamental algorithms are given for expressing ideals in canonical form, and concrete examples are demonstrated. A.R.H.

N77-28784*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics and Plasma Fusion Center.
REDUCTION OF THE EQUATION FOR LOWER HYBRID WAVES IN A PLASMA TO A NONLINEAR SCHROEDINGER EQUATION c64
Charles F. F. Karney *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 377-383 refs (For primary document see N77-28750 19-59)
(Contract E(11-1)-3070; Grant NSF ENG-76-06242)
Avail: NTIS HC A25/MF A01 CSCL 12A

Equations describing the nonlinear propagation of waves in an anisotropic plasma are rarely exactly soluble. However it is often possible to make approximations that reduce the exact equations into a simpler equation. The use of MACSYMA to make such approximations, and so reduce the equation describing lower hybrid waves into the nonlinear Schrodinger equation which is soluble by the inverse scattering method is demonstrated. MACSYMA is used at several stages in the calculation only because there is a natural division between calculations that are easiest done by hand, and those that are easiest done by machine. Author

N77-28785*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
RAY TRAJECTORIES IN A TORUS: AN APPLICATION OF MACSYMA TO A COMPLEX NUMERICAL COMPUTATION c61
John L. Kulp *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 385-393 refs (For primary document see N77-28750 19-59)
(Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 09B

The study of ray trajectories of plasma waves in a torodial geometry using MACSYMA is an example of how symbolic, numerical, and graphical facilities can be used in concert to accomplish a complex computational goal. Computational features of this study which are of particular significance include: the derivation of code (i.e. writing functions to generate program fragments), the use of array functions to simplify the specification of a numerical iteration scheme, and the graphical presentation of the results. Mathematically, this study originates in the solution of a linear inhomogeneous partial differential equation in 3 dimensions by the method of characteristics. While it is possible to describe this equation compactly by using vector notation, and by specifying the spatial variation of the coefficients in terms of intermediate parameters, the transformation of the equation into a form amenable to solution is very tedious. A MACSYMA program is presented for obtaining description of the rf field structure excited by a waveguide located at the edge of a toroidal plasma confinement device. Author

N77-28786*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF MACSYMA TO FIRST ORDER PERTURBATION THEORY IN CELESTIAL MECHANICS c90
John D. Anderson and Eunice L. Lau *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 395-404 refs (For primary document see N77-28750 19-59)
(Contract NAS7-100)
Avail: NTIS HC A25/MF A01 CSCL 03B

The application of MACSYMA to general first order perturbation theory in celestial mechanics is explored. Methods of derivation of small variations in the Keplerian orbital elements are developed. As an example of the methods, the small general relativistic perturbations on the two-body Newtonian motion, resulting from the rotation of the central body, are developed in detail. Author

N77-28787*# Waterloo Univ. (Ontario).
SYMBOLIC COMPUTATION OF RECURRENCE EQUATIONS FOR THE CHEBYSHEV SERIES SOLUTION OF LINEAR ODE'S c64
K. O. Geddes *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 405-423 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 12A

If a linear ordinary differential equation with polynomial coefficients is converted into integrated form then the formal substitution of a Chebyshev series leads to recurrence equations defining the Chebyshev coefficients of the solution function. An explicit formula is presented for the polynomial coefficients of the integrated form in terms of the polynomial coefficients of the differential form. The symmetries arising from multiplication and integration of Chebyshev polynomials are exploited in deriving a general recurrence equation from which can be derived all of the linear equations defining the Chebyshev coefficients. Procedures for deriving the general recurrence equation are specified in a precise algorithmic notation suitable for translation into any of the languages for symbolic computation. The method is algebraic and it can therefore be applied to differential equations containing indeterminates. Author

N77-28788*# Hawaii Univ., Honolulu.
SIN(X)2 + COS(X)**2 = 1 c64**
David R. Stoutemyer *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 425-433 refs (For primary document see N77-28750 19-59)
(Grant NSF MC5-75-22893)
Avail: NTIS HC A25/MF A01 CSCL 12A

Attempts to achieve tasteful automatic employment of the identities sin sq x + cos sq x = 1 and cos sq h x -sin sq h x

= 1 in a manner which truly minimizes the complexity of the resulting expression are described. The disappointments of trigonometric reduction, trigonometric expansion, pattern matching, Poisson series, and Demoivre's theorem are related. The advantages of using the method of comparative combinatorial substitutions are illustrated. Author

N77-28789*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science and Mathematics.
MATRIX COMPUTATIONS IN MACSYMA **c64**
Paul S. Wang *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 435-446 refs (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 12A

Facilities built into MACSYMA for manipulating matrices with numeric or symbolic entries are described. Computations will be done exactly, keeping symbols as symbols. Topics discussed include how to form a matrix and create other matrices by transforming existing matrices within MACSYMA; arithmetic and other computation with matrices; and user control of computational processes through the use of optional variables. Two algorithms designed for sparse matrices are given. The computing times of several different ways to compute the determinant of a matrix are compared. Author

N77-28790*# Hawaii Univ., Honolulu.
SYMBOLIC COMPUTER VECTOR ANALYSIS **c61**
David R. Stoutemyer *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 447-460 refs (For primary document see N77-28750 19-59)
(Grant NSF MCS-75-22893)
Avail: NTIS HC A25/MF A01 CSCL 09B

A MACSYMA program is described which performs symbolic vector algebra and vector calculus. The program can combine and simplify symbolic expressions including dot products and cross products, together with the gradient, divergence, curl, and Laplacian operators. The distribution of these operators over sums or products is under user control, as are various other expansions, including expansion into components in any specific othtogonal coordinate system. There is also a capability for deriving the scalar or vector potential of a vector field. Examples include derivation of the partial differential equations describing fluid flow and magnethohydrodynamics, for 12 different classic orthogonal curvilinear coordinate systems. Author

N77-28791*# Massachusetts Inst. of Tech., Cambridge. Stanford Artificial Intelligence Lab.
A NATURAL WAY TO DO SPATIAL LINEAR GEOMETRY IN MACSYMA **c61**
Juan Bulnes *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 461-471 (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 09B

A set of routines appropriate for use as an interactive aid in 3-dimensional calculations with planes, lines and points is presented. The mathematical language used is vector calculus. The simplicity with which these routines can be written in MACSYMA is demonstrated. Because of the natural way in which geometric intuition is mapped into them, they can serve as a model for an interactive computational aid for architects. Author

N77-28792*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
VARIETIES OF OPERATOR MANIPULATION **c61**
Alexander Doohovskoy *In* NASA. Langley Res. Center Proc. of the 1077 MACSYMA Users' Conf. 1977 p 473-490 refs (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 09B

A change in MACSYMA syntax is proposed to accommodate the operator manipulators necessary to implement direct and indirect methods for the solution of differential equations, calculus of finite differences, and the fractional calculus, as well as their modern counterparts. To illustrate the benefits and convenience of this syntax extension, an example is given to show how MACSYMA's pattern-matching capability can be used to implement a particular set of operator identities which can then be used to obtain exact solutions to nonlinear differential equations. Author

N77-28793*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VECTORIZATION OF LINEAR DISCRETE FILTERING ALGORITHMS
James R. Schiess Jul. 1977 17 p refs
(NASA-TM-X-3527; L-11448) Avail: NTIS HC A02/MF A01 CSCL 12A

Linear filters, including the conventional Kalman filter and versions of square root filters devised by Potter and Carlson, are studied for potential application on streaming computers. The square root filters are known to maintain a positive definite covariance matrix in cases in which the Kalman filter diverges due to ill-conditioning of the matrix. Vectorization of the filters is discussed, and comparisons are made of the number of operations and storage locations required by each filter. The Carlson filter is shown to be the most efficient of the filters on the Control Data STAR-100 computer. Author

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N77-28794 Purdue Univ., Lafayette, Ind.
THE OPTIMAL DISTRIBUTION OF DEVICE-DEPENDENT GRAPHICS FUNCTIONS Ph.D. Thesis
Richard Frank Puk 1976 156 p
Avail: Univ. Microfilms Order No. 77-1764

An integer programming model was developed with an accompanying methodology for applying it which produces the desired optimal distribution for a specific class of graphics functions. Difficulties which may arise in deriving the coefficients of the model and possible procedures for surmounting these difficulties were studied. The model was used to produce the optimal distribution for a particular display device and graphics system. The distribution was implemented and analyzed. In addition, the distribution was compared to a distribution obtained from an experienced systems programmer provided with the coefficients of the model. It was found that the model can indeed be useful in developing a graphics system. The model was found to be somewhat slow, indicating a need for research into more efficient integer programming techniques. Dissert. Abstr.

N77-28795*# Kanner (Leo) Associates, Redwood City, Calif.
OPERATING EFFICIENCY OF COMPUTERS
J. Pac Washington NASA Jul. 1977 7 p refs Transl. into ENGLISH from Mechanizace a Automatizace Administrativy (Czechoslovakia), vol. 15, no. 12, 1975 p 499-500
(NASA Order RA-35372-B)
(NASA-TM-75122) Avail: NTIS HC A02/MF A01 CSCL 09B

A method is outlined which can be used to guarantee to users of computing systems a measure of operating efficiency. The monthly utilization coefficient should be equal to or exceed a value agreed on in advance. In addition, the repair time during a computer breakdown should not be longer than a period agreed on in advance. Author

N77-28796# Pennsylvania Univ., Philadelphia. Wharton School of Finance and Commerce.
CHARGING FOR COMPUTER SERVICES Final Report
Dan Bernard, James C. Emery, Richard L. Nolan, and Robert H. Scott Feb. 1977 119 p refs
(Contract N00014-75-C-0462)
(AD-A038082; Rept-77-02-06) Avail: NTIS HC A06/MF A01 CSCL 09/2

Charging internally for the use of computer facilities is now a common organizational practice. A charge-out policy can play a major role in promoting effective and efficient utilization of computing resources. In practice, charging all too often fails to have a significant beneficial impact, and indeed can be a source

of tensions and user dissatisfaction. A charge-out system is most likely to be successful when it is based on an understanding of the purposes underlying charging and the requirements for it to be effective. This monograph is intended to contribute to such an understanding. Author (GRA)

N77-28797# Minnesota Univ., Minneapolis. Management Information Systems Research Center.

DIFFERENTIAL FILES: THEIR APPLICATION TO THE MAINTENANCE OF LARGE DATA BASES

Dennis G. Severance and Guy M. Lohman (Cornell Univ., Ithaca, N. Y.) Jan. 1976 23 p refs

(Contract N00014-75-C-1119)

(AD-A038200; MISRC-WP-76-05) Avail: NTIS HC A02/MF A01 CSCL 09/2

The representation of a collection of data in terms of its differences from some pre-established point of reference is a basic compaction technique which finds wide applicability. This paper describes a differential database representation which is shown to be an efficient method for storing large and volatile databases. The technique confines database modifications to a relatively small area of physical storage and as a result offers two significant operational advantages. First, because the reference point for the database is inherently static, it can be simply and efficiently stored. Moreover, since all modifications to the database are physically localized, the process of backup and the process of recovery are relatively fast and inexpensive. Author (GRA)

N77-28798# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.

IMPROVING THE THROUGHPUT OF PIPELINES WITH DELAYS AND BUFFERS Ph.D. Thesis

Janek H. Patel Oct. 1976 109 p refs

(Contract DAAB07-72-C-0259; Grant NSF MCS-73-03488)

(AD-A038338; R-747; UILU-ENG-76-2235) Avail: NTIS HC A06/MF A01 CSCL 09/2

A pipeline as defined here is a collection of segments of hardware which can operate simultaneously. A task flows synchronously from segment to segment for its execution. Each task follows one of several distinct task flow patterns which are assumed to be fixed and known in advance. It is characteristic of pipelines that a task can be initiated in the pipeline before an earlier initiated task has completed its execution. A problem arises when two or more tasks try to use the same segment at the same time, causing a collision. Such collisions can be avoided by appropriate scheduling of tasks and/or modification of the pipeline; or the collisions can be resolved at the time and place they occur. These alternatives are studied in this work with the objective that the throughput, i.e., average number of tasks processed per unit time, be maximized while providing considerable flexibility in scheduling of tasks. Collision characteristics of task schedules and pipelines are studied. A methodology for inserting fixed delays in a pipeline to achieve desired collision characteristics is presented. GRA

N77-28799# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

C.VMP: THE ANALYSIS, ARCHITECTURE AND IMPLEMENTATION OF A FAULT TOLERANT MULTIPROCESSOR Interim Report

Dan Siewiorek, Mark Canepa, and Steve Clark Dec. 1976 61 p refs

(Contract F44620-73-C-0074)

(AD-A038633; AFOSR-77-0449TR) Avail: NTIS HC A04/MF A01 CSCL 09/2

The architecture of a multiprocessor with a fault tolerant operating mode is described and analyzed. A bus level voter is used to satisfy the stringent design constraints of software transparency (programs form non-redundant versions will execute in a fault tolerant manner without modification), modularity, use of off-the-shelf components, and dynamic trading of performance for reliability. Bus level voting also allows handling of diverse system components (processors, memories, floppy disks, teletypes, etc.) in a uniform way. Models of performance degradation (20% slower than non-redundant on instruction execution rate, 50% slower on expected disk latency) and reliability improvement (both permanent and transient failures) are presented as well as experience in redundant system debugging, system initialization and switchover software, and initial performance measurements. The system, which is nearing completion, will be used to measure the occurrence of transient failures and to test fault tolerant bus protocols. Author (GRA)

N77-28800# Stanford Univ., Calif. Dept. of Computer Science.

DELETIONS THAT PRESERVE RANDOMNESS

Donald E. Knuth Dec. 1976 35 p refs

(Contract N00014-76-C-0330; Grant NSF MCS-72-03752)

(AD-A038865; SU-STAN-CS-76-584) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper discusses dynamic properties of data structures under insertions and deletions. It is shown that, in certain circumstances, the result of n random insertions and m random deletions will be equivalent to n-m random insertions, under various interpretations of the work random and under various constraints on the order of insertions and deletions. Author (GRA)

N77-28801# University of Southern Calif., Marina del Rey. Marina Del Rey Information Sciences Inst.

PRIM SYSTEM: OVERVIEW

Benjamin Britt, Alvin Cooperband, Louis Gallenson, and Joel Goldberg Mar. 1977 15 p refs Supersedes ISI/RR-74-29

(Contract DAHC15-72-C-0308; ARPA Order 2223)

(AD-A038894; ISI/RR-77-58; ISI/RR-74-29) Avail: NTIS HC A02/MF A01 CSCL 09/2

This document is an introduction to the services available with the Programming Research Instrument (PRIM), an interactive microprogrammable environment available to remote users through the ARPANET. PRIM, which runs under the TENEX timesharing system, makes it possible to create and use emulators of existing or newly specified computers, with major emphasis on debugging tools. PRIM and TENEX together provide not only editors, compilers, and debuggers for creating emulators, but also an environment for using the target systems, debuggers and configurors in the familiar language of the original system. Author (GRA)

N77-28802# Aerospace Corp., Kirtland AFB, N.Mex.

SURVEY OF DISPLAY DEVICES (HARD COPY)

C. L. Patterson Jun. 1976 50 p refs Sponsored in part by the Army

(Contract F04701-75-C-0076)

(AD-A036339; ETL-0086) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report determined the types of hard copy devices available, the relative advantages and disadvantages, and cost for the various systems. Manufacturers were identified that produced hard copy display systems. The objective of the report was to review as many types of instruments as could be located. Results of the survey found that there is little that is new in the field. The basic system types included flying spot scanning, a few laser devices, rotating drum with incoherent sources, and several flat bed systems based on microdensitometer techniques. Author (GRA)

N77-28803# Aerospace Corp., Kirtland AFB, N.Mex.

SURVEY OF DIGITAL IMAGE SCANNING SYSTEMS

M. M. Irvin Jun. 1976 48 p refs

(Contract F04701-75-C-0076)

(AD-A036337; ETL-0087) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report investigates currently available devices which digitize data from film to use as input to a digital computer. The report describes the general specifications for a scanning/digitizing system and describes the various available devices which meet the requirements. The report found that vidicon camera systems were the lowest cost scanners and the flying spot scanners were the most expensive. The most precise instrument, and the most expensive, is the flat bed microdensitometer. In conclusion, the application scenario must be known and the requirements carefully evaluated before any of the digitizing systems described in the report are selected. Author (GRA)

N77-28804# Aerospace Corp., Kirtland AFB, N.Mex.
SURVEY OF DIGITAL IMAGE DISPLAY SYSTEMS (SOFT COPY)
C. L. Patterson Jun. 1976 64 p refs
(Contract F04701-75-C-0076)
(AD-A036338; ETL-0085) Avail: NTIS HC A04/MF A01 CSCL 09/2

The survey in this report is directed toward the CRT display systems in order to assess the current state of interactive display systems. This report goes further than previous surveys in that monitor systems were reviewed independent of the total systems. Another primary element in the digital image display system is the refresh technology used by any system. This report pays particular attention to the refresh technique. The results show that most new developments in the field were predicted, such as solid state memory for refresh of the monitor and the appearance of a new '1000' line monitor from two suppliers.
Author (GRA)

N77-28805# Purdue Univ., Lafayette, Ind. Lab. for Applied Industrial Control.
AN INDEX TO THE MINUTES OF THE INTERNATIONAL PURDUE WORKSHOP INDUSTRIAL COMPUTER SYSTEMS AND ITS PREDECESSOR WORKSHOPS Final Report, 1 Feb. 1976 - 31 Jan. 1977
Theodore J. Williams Jan. 1977 223 p
(Contract N00014-76-C-0732)
(AD-A036476; Rept-88) Avail: NTIS HC A10/MF A01 CSCL 09/2

This report presents an Index of the technical contents of the Minutes of the International Purdue Workshop on Industrial Computer Systems and its predecessor and associated Workshops and Regional Meetings. It includes a list of authors and other contributors, a list of all registrants and a list of the companies and other organizations to which the registrants belonged.
Author (GRA)

N77-28806# Purdue Univ., Lafayette, Ind. Purdue Lab. for Applied Industrial Control.
SIGNIFICANT ACCOMPLISHMENTS AND DOCUMENTATION OF THE INTERNATIONAL PURDUE WORKSHOP ON INDUSTRIAL COMPUTER SYSTEMS. PART 1: EXTENDED FORTRAN FOR INDUSTRIAL REAL-TIME APPLICATIONS AND STUDIES ON PROBLEM-ORIENTED LANGUAGES Final Report, 1 Feb. 1976 - 31 Jan. 1977
Jan. 1977 298 p refs 6 Vol.
(Contract N00014-76-C-0732; NR Proj. 049-388)
(AD-A036453) Avail: NTIS HC A13/MF A01 CSCL 09/2

This volume represents Part 1 of a six volume set reproducing the major work accomplished by the International Purdue Workshop on Industrial Computer Systems during the past eight years. This material is reprinted from the Minutes of the several individual meetings of the Workshop and represents the work carried out by the standing committees of the Workshop.
Author (GRA)

N77-28807# Purdue Univ., Lafayette, Ind. Purdue Lab. for Applied Industrial Control.
SIGNIFICANT ACCOMPLISHMENTS AND DOCUMENTATION OF THE INTERNATIONAL PURDUE WORKSHOP ON COMPUTER SYSTEMS. PART 3: DEVELOPMENT IN INTERFACES AND DATA TRANSMISSION, IN MAN-MACHINE COMMUNICATIONS AND IN THE SAFETY AND SECURITY OF INDUSTRIAL COMPUTER SYSTEMS Final Report, 1 Feb. 1976 - 31 Jan. 1977
Jan. 1977 359 p refs 6 Vol.
(Contract N00014-76-C-0732; NR Proj. 049-388)
(AD-A036454) Avail: NTIS HC A16/MF A01 CSCL 09/2

This volume represents Part 3 of a six volume set reproducing the major work accomplished by the International Purdue Workshop on Industrial Computer Systems during the past eight years. This material is reprinted from the Minutes of the several individual meetings of the Workshop and represents the work carried out by the standing committees of the Workshop.
Author (GRA)

N77-28808# Purdue Univ., Lafayette, Ind. Purdue Lab. for Applied Industrial Control.
SIGNIFICANT ACCOMPLISHMENTS AND DOCUMENTATION OF THE INTERNATIONAL PURDUE WORKSHOP ON INDUSTRIAL COMPUTER SYSTEMS. PART 6: GUIDELINES FOR THE DESIGN OF MAN/MACHINE INTERFACES FOR PROCESS CONTROL Final Report, 1 Feb. 1976 - 31 Jan. 1977
Jan. 1977 111 p refs 6 Vol.
(Contract N00014-76-C-0732; NR Proj. 049-388)
(AD-A036457) Avail: NTIS HC A06/MF A01 CSCL 09/2

This volume represents Part 6 of a six volume set reproducing the major work accomplished by the International Purdue Workshop on Industrial Computer Systems during the past eight years. This material is reprinted from the Minutes of the Workshop and represents some of the Work carried out by the Man/Machine Communications Committee of the Workshop. Author (GRA)

N77-28809# Purdue Univ., Lafayette, Ind. Purdue Lab. for Applied Industrial Control.
SIGNIFICANT ACCOMPLISHMENTS AND DOCUMENTATION OF THE INTERNATIONAL PURDUE WORKSHOP ON INDUSTRIAL COMPUTER SYSTEMS. PART 5: DOCUMENT ON EXISTING AND PRESENTLY PROPOSED LANGUAGES RELATED TO THE STUDY OF THE WORKSHOP Final Report, 1 Feb. 1976 - 31 Jan. 1977
Jan. 1977 267 p refs 6 Vol.
(Contract N00014-76-C-0732)
(AD-A036455) Avail: NTIS HC A12/MF A01 CSCL 09/2

This volume represents Part 5 of a six volume set reproducing the major work accomplished by the International Purdue Workshop on Industrial Computer Systems during the past eight years. This material is reprinted from the Minutes of the several individual meetings of the Workshop and represents the work carried out by the standing committees of the Workshop.
Author (GRA)

N77-28810# Massachusetts Inst. of Tech., Cambridge.
ON IDIOSYNCRATIC SYSTEMS. PART 1: IDIOSYNCRATIC SYSTEMS. PART 2: ON BEING CREATIVE WITH COMPUTER AIDED DESIGN Technical Report, 1 Jan. 1976 - 31 Mar. 1977
Nicholas Negroponte 31 Mar. 1977 37 p refs
(Contract N00014-75-C-0460; NR Proj. 049-354)
(AD-A038162; NN-100-1) Avail: NTIS HC A03/MF A01 CSCL 05/8

In part I, the author discusses a personalized computer -- an idiosyncratic system intimately acquainted with a specific user. Familiarity is gained over time, through shared experiences, and in context-dependent, interpersonal hypotheses. Personalization offers the possibility of machine recognition and understanding of conversations that otherwise appear ambiguous, incomplete, or vague. The paper postulates powerful, dedicated, and ubiquitous machines. We present a modest example of how the user can help the computer. In part II, the author considers creativity in the context of computer aided design. Following introductions to theories about creativity, and computer graphics, the paper presents four settings for the computer as a wholesale slave, a virtuoso, a creativogenic tolerance, and a place. They progress from a compliant and partitioned system to well-disposed and redundant surround. The paper concludes with some of the ingredients for highly personalized design systems, so-called idiosyncratic systems.
GRA

N77-28811# Computer Sciences Corp., Falls Church, Va.
CSEL INTERFACE UPDATE: K-BAND MICROPROCESSOR Final Report, Mar. 1975 - Jun. 1976
Douglas O. Alwine, Robert A. Glicksman, Richard G. Murray, and Charles F. Pavey Wright-Patterson AFB, Ohio AFAL Dec. 1976 169 p refs
(Contract F33615-75-C-1229)
(AD-A036203; CSC-R-3328-1; AFAL-TR-76-169) Avail: NTIS HC A08/MF A01 CSCL 09/2

The objective of this demonstration/study is to provide the Air Force with basic data and techniques for expanding the capabilities of the K-Band Terminal Simulator. The current simulator consists of three communication channels, each with several real-time effects (Doppler shift, frequency hop, signal fading, and MFSK) driven by a minicomputer which updates all of these real-time effects every 5 milliseconds. Expansion of the

K-Band Terminal Simulator along present lines would increase the burden on the minicomputer and therefore increase the basic 5 millisecond time step, which may already be too long for some applications. The results of this study show that an alternative, vastly superior approach to expansion of the simulator would be to use a separate microprocessor to drive each individual channel. This would relieve the main minicomputer of the fast real-time chores and leave it with only non-time critical system control, operator interface, and housekeeping tasks. This approach would give almost unlimited expansion capability and would allow reducing the basic time step somewhat. Complete results, along with all hardware and software documentation are contained in this final report. GRA

N77-28812# Defense Documentation Center, Alexandria, Va.
COMPUTERS IN INFORMATION SCIENCES: DIGITAL COMPUTER SYSTEMS Report Bibliography, Jan. 1968 - Jun. 1976
Feb. 1977 264 p refs Supersedes DDC-TAS-13-15
(AD-A036525; DDC/BIB-77/01; DDC-TAS-13-15) Avail: NTIS HC A12/MF A01 CSCL 09/2

This bibliography contains 170 unclassified and unlimited citations primarily dealing with Computers In Information Sciences and compiles references dealing specifically with Digital Computer Systems. Indexes of Corporate Author-Monitoring Agency, subject, title and personal author are included. Author (GRA)

N77-28813# Ohio State Univ., Columbus. Computer and Information Science Research Center.
THE ARCHITECTURE OF A DATABASE COMPUTER. PART 3: THE DESIGN OF THE MASS MEMORY AND ITS RELATED COMPONENTS
David K. Hsiao and Krishnamurthi Kannan Dec. 1976 145 p refs
(Contract N00014-75-C-0573)
(AD-A036217; OSU-CISRC-TR-76-3) Avail: NTIS HC A07/MF A01 CSCL 09/2

This is the last of the three-part series which deals with the design of a back-end computer known as the database computer (DBC). The concepts and capabilities of the DBC were presented in Part I. Schematically, the DBC architecture consists of two loops of memories and processors, namely, the structure loop and the data loop. The structure loop is composed of four components: the structure transformation unit (KXU), the structure memory (SM), the structure memory information processor (SMIP) and the index translation unit (IXU). The design philosophy, implementation details and hardware organizations of the structure loop components were documented in Part 2. In this report, the design of the data loop is presented. In addition, the database command and control processor (DBCCP), which regulates the operations of both the structure and data loops and interfaces with the front-end computer systems, is also presented. The DBCCP processes all DBC commands received from the front-end computer systems, schedules the execution of the commands on the basis of the command type and priority, enforces security on a selective basis, clusters records to be stored in the DBC and routes the response set to the front-end computer systems. GRA

N77-28814# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
ROUNDOFF NOISE IN FIXED-POINT RECURSIVE DIGITAL FILTERS M.S. Thesis
Dale John Mayer Sep. 1976 75 p refs
(Contract DAAB07-72-C-0259)
(AD-A036230; R-746; UILU-ENG-76-2234) Avail: NTIS HC A04/MF A01 CSCL 09/2

Digital filtering techniques are very appealing where complex signal processing is desired. A major problem with digital filters however is the effect of quantization errors due to finite precision arithmetic. This report is concerned with roundoff errors (due to truncation or rounding) occurring after each multiplication in linear shift-invariant fixed-point recursive digital filters. The accumulation of these errors appears as noise (error uncorrelated) or limit cycles (correlated errors) at the filter output, thus limiting the dynamic range of the filter operating with a given wordlength. Author (GRA)

N77-28815# Georgia Univ., Athens. Dept. of Statistics and Computer Science.
GRAPHICAL AIDS FOR STATISTICAL COMPUTATION
Walter P. Bond and Rolf E. Bargmann Dec. 1976 343 p refs
(Contract N0014-69-A-0423)
(AD-A036346; TR-112; THEMIS-UGA-37) Avail: NTIS HC A15/MF A01 CSCL 09/2

This report describes development and documentation of a set of programs for interactive use with graphics (IBM 360/370 with 2250 terminal), for the construction and evaluation of response surfaces, and for plotting and expanding statistical distribution functions. A facility is included to update and add new functions. Examples and sample displays are included for response surface optimization, process evaluation, likelihood function, power functions, multiple correlation distributions, Lelimann test, and distribution of the largest characteristic root. Author (GRA)

N77-28816# Naval Postgraduate School, Monterey, Calif.
EMULATION OF THE AN/UYK-20 TACTICAL DATA COMPUTER ON THE BURROUGHS D-MACHINE M.S. Thesis
Ralph Harry Anzelmo and Theodore Lawrence Kaye Mar. 1977 264 p refs
(AD-A039170) Avail: NTIS HC A12/MF A01 CSCL 09/2

A representation of the Univac AN/UYK-20 computer systems has been emulated on the Burroughs D Interpreter-Based System. The entire AN/UYK-20 instruction repertoire has been emulated with the exception of the 'math pac' option (floating point arithmetic and cordic functions), clock and interrupt codes, and input/output operation codes. Modular design with extensive documentation has been implemented throughout program development allowing for ease of modification and further extensions to the existing emulation. Emulation and hardware architecture of the AN/UYK-20 and the Burroughs D-machine, are discussed in conjunction with the AN/UYK-20 itself. Methods of testing and debugging, sample test programs and recommendations for continued design modifications to the emulation are presented. Author (GRA)

N77-28817# Purdue Univ., Lafayette, Ind. Lab. for Applied Industrial Control.
SIGNIFICANT ACCOMPLISHMENTS AND DOCUMENTATION OF THE INTERNATIONAL PURDUE WORKSHOP ON INDUSTRIAL COMPUTER SYSTEMS. PART 4: SOME REPORTS ON THE STATE-OF-THE-ART AND FUNCTIONAL REQUIREMENTS FOR FUTURE APPLICATIONS Final Report, 1 Feb. 1976 - 31 Jan. 1977
Jan. 1977 320 p
(Contract N00014-76-C-0732)
(AD-A036456) Avail: NTIS HC A14/MF A01 CSCL 09/2

This volume represents Part 4 of a six volume set reproducing the major work accomplished by the International Purdue Workshop on Industrial Computer Systems during the past eight years. This material is reprinted from the minutes of the several individual meetings of the Workshop and represents the work carried out by the standing committees of the Workshop. Author (GRA)

N77-28818# Purdue Univ., Lafayette, Ind. Lab. for Applied Industrial Control.
SIGNIFICANT ACCOMPLISHMENTS AND DOCUMENTATION OF THE INTERNATIONAL PURDUE WORKSHOP ON INDUSTRIAL COMPUTER SYSTEMS. PART 2: THE LONG TERM PROCEDURAL LANGUAGE Final Report, 1 Feb. 1976 - 31 Jan. 1977
Jan. 1977 280 p
(Contract N00014-76-C-0732)
(AD-A036475) Avail: NTIS HC A13/MF A01 CSCL 09/2

This volume represents Part 2 of a six volume set reproducing the major work accomplished by the International Purdue Workshop on Industrial Computer Systems during the past eight years. This material is reprinted from the minutes of the several individual meetings of the Workshop and represents the work carried out by the standing committees of the Workshop. Author (GRA)

N77-28819# National Bureau of Standards, Washington, D. C. Systems Architecture Section.
AUTOMATIC DATA PROCESSING RISK ASSESSMENT Interim Report
Susan K. Reed Mar. 1977 36 p refs
(PB-265950/6; NBSIR-77-1228) Avail: NTIS HC A03/MF A01 CSCL 09B

A technique for conducting a risk analysis of an ADP facility is described. For the purpose of clarity, the ADP facility of a hypothetical Federal agency is used for an example. The characteristics and attributes which must be known in order to perform a risk analysis are described, and the process of analyzing some of the assets is demonstrated, showing how the problem of risk analysis can be reduced to manageable proportions. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N77-28820 Purdue Univ., Lafayette, Ind.
DIGITAL SIMULATION OF UNBALANCED FAULTS ON SYNCHRONOUS MACHINES Ph.D. Thesis
Russel John Kerkman 1976 160 p
Avail: Univ. Microfilms Order No. 77-1734

A d-g-O mathematical development of unbalanced faults and operation of synchronous machines is presented. The d-q-O development of a single line to ground fault is applied first to a single machine system. Verification is achieved by a comparison of a digital simulation of the d-q-O development with an analog computer study. The addition of a transformer, to isolate the machine from the unbalanced fault, is included in both representations and the advantages of the d-q-O development are discussed. A development of a d-q-O representation for a line to ground fault applied to a two machine system is included. The resulting equations do not require the inversion of machine equations and provide a basis for extension to larger systems.
Dissert. Abstr.

N77-28821 State Univ. of New York, Buffalo.
INTERACTIVE COMPUTER METHODS FOR DESIGN OPTIMIZATION Ph.D. Thesis
Khurshid Alimohammed Afimiwala 1976 341 p
Avail: Univ. Microfilms Order No. 77-3503

The integration of graphical methods, optimization techniques, and the user's decision making abilities into a unified computer package for interactive design optimization was investigated. A method is developed for graphically presenting objective function and constraint contours in two dimensions using curve fitting and nonparametric curve generation techniques. Two applications are solved using ADOPT and GDOPT. In the first application the effectiveness of these interactive methods in solving dynamic problems is illustrated by the design of compensators for closed loop feedback control systems. The second application investigates the design of a compact heat exchanger to achieve a trade-off between operation power and volume and illustrates how interactive design techniques assist in eliminating design variables and thus simplifying the search for the minimum.
Dissert. Abstr.

N77-28822 Texas Univ., Austin.
COMPUTER UNDERSTANDING OF PHYSICS PROBLEMS STATED IN NATURAL LANGUAGE Ph.D. Thesis
Gordon Shaw Novak, Jr. 1976 130 p
Avail: Univ. Microfilms Order No. 77-4008

A computer program is described called ISAAC, which can read, understand, solve and draw pictures of physics problems stated in English. The program has solved twenty problems, most of which were taken unedited from high school and college physics texts. These problems involve rigid bodies in static equilibrium, and include such objects as levers, pivots, weights, ropes, and springs in various configurations. Ways in which the meanings of phrases and sentences may be understood and related to a developing model of the problem, using common sense knowledge (represented by computer programs) to aid the understanding process, are investigated. Ways of representing objects and their relationships are developed. These representations, which are originally created in response to the sentence in the problem statement, are further elaborated by processes which construct a geometric model of the problem, associate canonical objects (such as a point mass) with physical objects (such as a person), write and solve equations which describe the interactions of the objects, and construct a diagram of the problem. The techniques used in ISAAC have potential application in providing a natural language interface between specialist programs and users who are not computer professionals, and in computer programs for teaching physics and other technical subjects.
Dissert. Abstr.

N77-28823 North Carolina Univ., Chapel Hill.
AN EXPERIMENTAL ANALYSIS OF PROGRAM VERIFICATION METHODS Ph.D. Thesis
William C. Hetzel 1976 297 p
Avail: Univ. Microfilms Order No. 77-2047

A controlled experiment was designed and conducted in order to analyze program verification methods. Three basic verification methods were selected. One was reading, the second was specification testing, and the third was selective testing. Three structured PL/I programs were specially prepared by reinserting a number of errors that had been uncovered during their development. On the average, subjects found little more than half of the errors present, even on a severity-weighted basis. The experiment showed that an intensive period of independent verification under near optimal conditions is not likely to find all errors even in simple, well-written programs. Many other analyses of the data were also conducted. One set of analyses looked at the individual performance differences. Computing education and experience were found to be significantly associated with good performance. Self estimates and attitudes were also related. Additional analyses included an analysis of method effectiveness on individual errors, an analysis of the distribution of time between errors, a factor analysis, and a regression prediction model.
Dissert. Abstr.

N77-28824 North Carolina Univ., Chapel Hill.
THE USE OF A KINESTHETIC SUPPLEMENT IN AN INTERACTIVE GRAPHICS SYSTEM Ph.D. Thesis
Paul Jerome Kilpatrick 1976 182 p
Avail: Univ. Microfilms Order No. 77-2061

Force cues used to augment visual cues in an interactive computer graphics system are considered. An informal experiment was conducted to determine how useful the force cues are in comparison to several visual cues. The conclusion was that those cues are more useful than some widely-used visual cues, and that they improve the operational effectiveness of the visual system. This system also served as the starting point for an analysis of the human factors of more general kinesthetic display systems. The characteristics of a proposed kinesthetic display are delineated.
Dissert. Abstr.

N77-28825 Purdue Univ., Lafayette, Ind.
SPEEDUP IN PARALLEL ALGORITHMS FOR ADAPTIVE QUADRATURE Ph.D. Thesis
James Milton Lemme 1976 139 p
Avail: Univ. Microfilms Order No. 77-1738

Rice has proposed a metalgorithm for adaptive quadrature and extended it to asynchronous parallel processing. By adding some auxiliary processors to Rice's metalgorithm and distributing the contents of the interval collection among the interval processors, a cycle time was achieved proportional to log P (base 2). This leads to speedup results which say that when a sufficiently large number of function evaluations are performed in estimating an integral, the time required to generate this estimate is directly proportional to the cycle time and the number of function evaluations involved, and is inversely proportional to the number of interval processors used. It is found that adaptive algorithms for ILLIAC 4 which are not designed for maximum processor utilization are faster than those which are. In general, the ILLIAC 4 algorithms are faster than the ASC algorithm, although this may not be true for a 4-pipe ASC. Dissert. Abstr.

N77-28826 State Univ. of New York, Buffalo.
THREE-DIMENSIONAL SURFACE FINDING AND DISPLAY

OF MOVING OBJECTS Ph.D. Thesis
Hsun Kao Liu 1976 139 p
Avail: Univ. Microfilms Order No. 77-3558

A computer algorithm for obtaining boundaries in two dimensional, three dimensional and four dimensional space was designed and implemented. The four dimensional version of the algorithm was appropriate for detecting the dynamically changing surface of an organ such as the breathing lung or the beating heart from a time sequence of three dimensional density distributions, making essential use of the temporal information. A special purpose, three dimensional display algorithm is described which can be used to display boundary surfaces three dimensionally. A computerized method to display a section at arbitrary orientation through the three dimensional object is also described. Results produced by the algorithm as applied in various medical areas are shown with emphasis on the display of three dimensional information in reconstructions produced by computerized X-ray tomography. Dissert. Abstr.

N77-28827*# Texas A&M Research Foundation, College Station. Dept. of Mathematics.
IMAGE ANALYSIS LIBRARY SOFTWARE DEVELOPMENT Final Report, 2 Feb. 1976 - 31 May 1977
L. F. Guseman, Jr. and Jack Bryant 31 May 1977 13 p refs (Contract NAS9-14904)
(NASA-CR-151469) Avail: NTIS HC A02/MF A01 CSCL 09B

The Image Analysis Library consists of a collection of general purpose mathematical/statistical routines and special purpose data analysis/pattern recognition routines basic to the development of image analysis techniques for support of current and future Earth Resources Programs. Work was done to provide a collection of computer routines and associated documentation which form a part of the Image Analysis Library. Author

N77-28828*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A PARAMETER ESTIMATION SUBROUTINE PACKAGE
G. J. Bierman and W. M. Nead 1 Jul. 1977 100 p refs (Contract NAS7-100)
(NASA-CR-154109; JPL-Publ-77-26) Avail: NTIS HC A05/MF A01 CSCL 09B

Linear least squares estimation and regression analyses continue to play a major role in orbit determination and related areas. FORTRAN subroutines have been developed to facilitate analyses of a variety of parameter estimation problems. Easy to use multipurpose sets of algorithms are reported that are reasonably efficient and which use a minimal amount of computer storage. Subroutine inputs, outputs, usage and listings are given, along with examples of how these routines can be used. Author

N77-28829*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VICAR IMAGE PROCESSING SYSTEM GUIDE TO SYSTEM USE
Joel B. Seidman 1 May 1977 59 p refs Revised (Contract NAS7-100)
(NASA-CR-154102; JPL-Publ-77-37) Avail: NTIS CSCL 09B

The functional characteristics and operating requirements of the VICAR (Video Image Communication and Retrieval) system are described. An introduction to the system describes the functional characteristics and the basic theory of operation. A brief description of the data flow as well as tape and disk formats is also presented. A formal presentation of the control statement formats is given along with a guide to usage of the system. The guide provides a step-by-step reference to the creation of a VICAR control card deck. Simple examples are employed to illustrate the various options and the system response thereto. Author

N77-28830*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF VIRTUAL MEMORY ON EFFICIENT SOLUTION OF TWO MODEL PROBLEMS
Jules J. Lambiotte, Jr. Washington Jul. 1977 14 p refs
(NASA-TM-X-3512; L-11490) Avail: NTIS HC A02/MF A01 CSCL 09B

Computers with virtual memory architecture allow programs to be written as if they were small enough to be contained in memory. Two types of problems are investigated to show that this luxury can lead to quite an inefficient performance if the programmer does not interact strongly with the characteristics of the operating system when developing the program. The two problems considered are the simultaneous solutions of a large linear system of equations by Gaussian elimination and a model three-dimensional finite-difference problem. The Control Data STAR-100 computer runs are made to demonstrate the inefficiencies of programming the problems in the manner one would naturally do if the problems were indeed, small enough to be contained in memory. Program redesigns are presented which achieve large improvements in performance through changes in the computational procedure and the data base arrangement. Author

N77-28831*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER PROGRAMS FOR THE INTERPRETATION OF LOW RESOLUTION MASS SPECTRA: PROGRAM FOR CALCULATION OF MOLECULAR ISOTOPIC DISTRIBUTION AND PROGRAM FOR ASSIGNMENT OF MOLECULAR FORMULAS
Robert A. Miller and Fred J. Kohl Washington Jul. 1977 18 p refs
(NASA-TM-X-3564; E-9133) Avail: NTIS HC A02/MF A01 CSCL 09B

Two FORTRAN computer programs for the interpretation of low resolution mass spectra were prepared and tested. One is for the calculation of the molecular isotopic distribution of any species from stored elemental distributions. The program requires only the input of the molecular formula and was designed for compatability with any computer system. The other program is for the determination of all possible combinations of atoms (and radicals) which may form an ion having a particular integer mass. It also uses a simplified input scheme and was designed for compatability with any system. Author

N77-28832*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLUID: A NUMERICAL INTERPOLATION PROCEDURE FOR OBTAINING THERMODYNAMIC AND TRANSPORT PROPERTIES OF FLUIDS
Theodore E. Fessler Washington Aug. 1977 27 p refs
(NASA-TM-X-3572; E-9132) Avail: NTIS HC A03/MF A01 CSCL 09B

A computer program subroutine, FLUID, was developed to calculate thermodynamic and transport properties of pure fluid substances. It provides for determining the thermodynamic state from assigned values for temperature-density, pressure-density, temperature-pressure, pressure-entropy, or pressure-enthalpy. Liquid or two-phase (liquid-gas) conditions are considered as well as the gas phase. A van der Waals model is used to obtain approximate state values; these values are then corrected for real gas effects by model-correction factors obtained from tables based on experimental data. Saturation conditions, specific heat, entropy, and enthalpy data are included in the tables for each gas. Since these tables are external to the FLUID subroutine itself, FLUID can implement any gas for which a set of tables has been generated. (A setup phase is used to establish pointers dynamically to the tables for a specific gas.) Data-table preparation is described. FLUID is available in both SFTRAN and FORTRAN Author

N77-28833# PRC Information Sciences Co., McLean, Va.
RASTER IMAGING SOFTWARE Final Technical Report, Jul. 1974 - Jun. 1976
R. Lubbes, Patricia A. Macera, and Kathryn S. Przewlocki Mar. 1977 69 p
(Contract F30602-74-C-0345)
(AD-A039024; RADC-TR-76-340-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 09/2

The Raster Imaging Software was developed to support raster plotting capabilities existing at RADC. The software consists of (1) interactive symbol and text placement capability which operates on the RADC Experimental Compilation Console; and (2) batch processing software to convert lineal data to raster for plotting. Included in the lineal to raster conversion software in addition to creating line weights is the capability to fill areas with a solid fill or pattern fill, to fill between contours of different

elevations (elevation tints) to perform priority masking, and to generate point symbols and alpha-numerics in raster format.
Author (GRA)

N77-28834# PRC Information Sciences Co., McLean, Va.
RASTER IMAGING SOFTWARE. USERS GUIDE Final Technical Report, Jul. 1974 - Jun. 1976
R. Lubbes, Patricia A. Macera, and Kathryn S. Przewlocki Mar. 1977 186 p
(Contract F30602-74-C-0345)
(AD-A038851; RADC-TR-76-340-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 09/2

The Raster Imaging Software was developed to support raster plotting capabilities existing at RADC. The software consists of (1) interactive symbol and text placement capability which operates on the RADC Experimental Compilation Console; and (2) batch processing software to convert lineal data to raster for plotting. Included in the lineal to raster conversion software in addition to creating line weights is the capability to fill areas with a solid fill or pattern fill, to fill between contours of different elevations (elevation tints) to perform priority masking, and to generate point symbols and alphanumerics in raster format.
Author (GRA)

N77-28835# Syracuse Univ., N. Y. School of Computer and Information Science.
DECODING COMPLEXITY STUDY II Phase Report, Jun. 1974 - Nov. 1976
Luther D. Rudolph Griffiss AFB, N.Y. RADC Mar. 1977 62 p refs
(Contract F30602-75-C-0121; Grant NSF ENG-75-07709)
(AD-A039023; RADC-TR-77-103) Avail: NTIS HC A04/MF A01 CSCL 09/4

This report presents the most recent results of an investigation into the complexity of decoding error-correcting codes and the development of efficient and practical decoding techniques. The most important result has been the discovery of a new general mathematical framework in which digital decoding and analog demodulation become special cases of a more general class of decoding-demodulation functions. Although we have only just begun to explore the many possibilities opened up by this discovery, results of practical importance have already been produced, including an optimum soft-decision symbol-by-symbol decoding algorithm for linear codes whose complexity varies inversely with code rate.
Author (GRA)

N77-28836# Stanford Univ., Calif. Systems Optimization Lab.
COMPUTER PROGRAMS FOR DECOMPOSITION IN INTEGER PROGRAMMING.
Gary A. Kochman Sep. 1976 165 p refs
(Contracts N00014-76-C-0418; DAAC29-74-C-0079; F44620-74-C-0079)
(AD-A038322; SU-SOL-76-20; ARO-12215.13-M) Avail: NTIS HC A08/MF A01 CSCL 09/2

This report gives documentations for two computer codes, DSLC and DMLC for solving block angular integer programming problems. The first code, DSLC, is for the single linking constraint case and the second DMLC is for the multiple linking constraint case.
Author (GRA)

N77-28837# Pattern Analysis and Recognition Corp., Rome, N. Y.
THE WAVEFORM PROCESSING SYSTEM (WPS) Final Report
Probal K. Sanyal Griffiss AFB, N.Y. RADC Feb. 1977 60 p refs
(Contract F30602-72-C-0193; AF Proj. 5597)
(AD-A038336; PAR-76-6-Vol-4-Pt-1; RADC-TR-76-224-Vol-4-Pt-1) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report contains the computer software documentation for the Waveform Processing System (WPS) developed by Pattern Analysis and Recognition Corporation for the Rome Air Development Center. The Waveform Processing System consists of (1) algorithms for performing mathematical operations on waveform data, (2) a language for extracting feature vectors from the waveform, and (3) algorithms for analyzing these vectors to develop pattern classification logic.
Author (GRA)

N77-28838# Mitre Corp., Bedford, Mass.
SOFTWARE ACQUISITION MANAGEMENT GUIDEBOOK: SOFTWARE DEVELOPMENT AND MAINTENANCE FACILITIES
D. R. Peterson Apr. 1977 88 p refs
(Contract F19628-77-C-0001; AF Proj. 5720)
(AD-A038234; MTR-3330; ESD-TR-77-130) Avail: NTIS HC A05/MF A01 CSCL 09/2

This document is one of a series of guidebooks covering important aspects of software acquisition. The guidebooks are prepared for use by Air Force program office personnel responsible for the management and planning of software development. This guidebook focuses on the management decisions and technical issues related to planning and acquisition of software development and maintenance facilities.
Author (GRA)

N77-28839# Polytechnic Inst. of New York. Dept. of Electrical Engineering and Electrophysics.
SUMMARY OF TECHNICAL PROGRESS, SOFTWARE MODELING STUDIES Interim Report, 1 Jul. - 31 Dec. 1976
M. L. Shooman and H. Ruston Mar. 1977 48 p refs
(Contract F30602-74-C-0294)
(AD-A038508; Poly-EE/EP-76-023; RADC-TR-77-88) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report presents the progress of Polytechnic Institute of New York research in the area of software reliability. Subjects of continuing investigation are as follows: work in progress includes development of a micro reliability model, incorporating representative features of the internal program structure, involving path (module) traversed frequencies and times and path failure probabilities parameters; extension of software physics formulas to define a measure of complexity; planning and execution of small scale tests for gathering of parameters to verify modeling techniques; continuation of work on automatic and modular techniques for constructing low-cost, low-error content application programs; measurement of program length and complexity based on the application of statistical natural language theory - (Zipf's Laws on work probabilities); algorithms for the enumeration of feasible program test paths; and development of driver programs for testing every program path at least once.
GRA

N77-28840# Wisconsin Univ., Madison. Mathematics Research Center.
SOFTWARE FOR INTERVAL ARITHMETIC: A REASONABLY PORTABLE PACKAGE
J. M. Yohe Mar. 1977 25 p refs
(Contract DAAG29-75-C-0024)
(AD-A038963; MRC-TSR-1731) Avail: NTIS HC A02/MF A01 CSCL 09/2

One means of bounding the error in digital computation is through the use of interval, or range, arithmetic; instead of computing with approximate real numbers, one calculates with pairs of approximate real numbers -- the first member of a pair being a lower bound for the true result, and the second an upper bound. By this method, one can take into account such varied sources of error as uncertainty in input data, inaccuracies in mathematical formulae, and errors in approximation of real numbers and the operations on them. The theory of interval arithmetic is developed extensively elsewhere. The major obstacle to the use of interval arithmetic is the unavailability of software. INTERVAL is not a standard data type in any production language that we know of; preparation of a package of subprograms to handle interval data is a nontrivial task.
GRA

N77-28841# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
DYNAMIC PROGRAMMING IN COMPLETE SEPARABLE SPACES Ph.D. Thesis
Steven Eugene Shreve Jan. 1977 153 p refs
(Contract DAAB07-72-C-0259; Grant NSF-ENG-74-19332)
(AD-A038337; R-755; UILU-ENG-77-2202) Avail: NTIS HC A08/MF A01 CSCL 12/2

The discrete time stochastic decision model is a mathematical

abstraction of the situation in which a system progresses from state to state incurring a cost at each transition. The cost could be assigned to reflect the preference one has for one state over another or could be the genuine cost of say, operating a business, during the period of transition. A decision maker has some influence over the stochastic manner of the transition but cannot choose deterministically the state into which the system will move. He wishes, of course, to exercise his influence to minimize the total expected cost of all transitions. Thus he must not only take into account the cost of the present transition, but rather must balance his desire to minimize this against his desire to avoid moving to a state where a high future cost is unavoidable. Author (GRA)

N77-28842# System Development Corp., Santa Monica, Calif.
SOFTWARE DATA COLLECTION STUDY. VOLUME 7: COMPENDIUM OF PROCEDURES AND PARAMETERS Final Technical Report, Jun. 1975 - Jun. 1976
M. Finfer and M. Templeton Griffiss AFB, N. Y. RADC Dec. 1976 292 p
(Contract F30602-75-C-0248)
(AD-A036247; SDC-TM-5542/007/01-Vol-7; RADC-TR-76-329-VOL-7) Avail: NTIS HC A13/MF A01 CSCL 09/2

This compendium supports the RADC Software Data Collection Study for providing an annotated compilation of recommended data collection forms, a suggested data base structure, and a summary list of definitions of the data parameters. A modular design approach was taken to the construction of the forms and the suggested data base structure. Data item priorities, collection frequency, and project size and complexity requirements were taken into account in defining modules. The system is deemed flexible in meeting the needs of future changes and expansions to the RADC repository operations.
Author (GRA)

N77-28843# System Development Corp., Santa Monica, Calif.
SOFTWARE DATA COLLECTION STUDY. VOLUME 8: GLOSSARY Final Technical Report, Jun. 1975 - Jun. 1976
N. E. Willmorth Griffiss AFB, N. Y. RADC Dec. 1976 42 p
(Contract F30602-75-C-0248)
(AD-A036265; RADC-TR-76-326-Vol-8; SDC-TM-5542/08/01) Avail: NTIS HC A03/MF A01 CSCL 09/2

This volume consists of a glossary of terms pertinent to the technical reports resulting from the RADC Software Data Collection Study. The glossary does not repeat definitions of most commonly used data processing terms. Author (GRA)

N77-28844# Naval Postgraduate School, Monterey, Calif.
AN ANALYSIS OF DATA BASE QUERY LANGUAGES M.S. Thesis
Dennis Elliot Lough and Allen Dale Burns Mar. 1977 63 p refs
(AD-A039783) Avail: NTIS HC A04/MF A01 CSCL 09/2

An abundance of data base management systems and query languages already exist, not to mention those which have been, and continue to be proposed. Most data base management system surveys focus on the type of model used to represent the data, methods of access, protection, etc. This paper acquaints the EDP manager with the fundamental differences among the more significant query languages, with emphasis on those characteristics which should be considered when choosing a query language. The term query language as used here has been expanded to include the entire user interface to the data base, and encompass both data sublanguages and stand-alone query languages. Author (GRA)

N77-28845# EG and G Washington Analytical Services Center, Inc., Rockville, Md.
A DIRECTORY TO COLLECTIONS OF ENGINEERING COMPUTER PROGRAMS Final Report
Jan. 1977 209 p refs
(Contract N00014-76-C-0534)
(AD-A036193; CHES/NAVFAC-FPO-1-77(5)) Avail: NTIS HC A10/MF A01 CSCL 09/2

This directory contains descriptions of 54 compendiums of computer programs relating to engineering problems. It is based on a survey of organizations that create, use, or distribute computer programs. The descriptions concentrate on three aspects of each compendium: bibliographic information about the compendium itself, format data, and the subject areas treated by the computer programs in the compendium. Cross referenced source and subject indices are provided. Author (GRA)

N77-28846# Polytechnic Inst. of New York, Brooklyn. Dept. of Electrical Engineering and Electrophysics.
SEEDING/TAGGING ESTIMATION OF SOFTWARE ERRORS: MODELS AND ESTIMATES Technical Report, 1 Apr. 1974 - 30 Jun. 1976
B. Rudner Griffiss AFB, N. Y. RADC Jan. 1977 71 p refs
(Contract F30602-74-C-0294)
(AD-A036655; Poly-EE/EP-76-019; RADC-TR-77-15) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report concerns itself with seeding/tagging estimates of the number of software errors based on the number of errors either inserted deliberately in a program (seeded) or found by debugging (tagged), the number of errors found by a debugger unaware of the first set, and the number of errors appearing in both sets. Estimates from 3 models are discussed. Model 1 assumes all errors are equally open to discovery at all times. Models 2 and 3 assume categories of difficulty exist and that any error which appears can be assigned to the proper category. Model 2 does not assume the relative distribution of errors among categories is known, while Model 3 does. The mean and mean-squared error of a maximum likelihood estimate and a modified maximum likelihood estimate are given for all 3 models. It is shown how these quantities vary with certain relations among the total number of errors, size of tagged or seeded set, and size of accompanying sample set. A procedure for determining optimum values for size of tagged or seeded set and number found by the second debugger is outlined. Finally, multi-trial estimates for parameters are found and compared with single-trial estimates. Author (GRA)

N77-28847# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
A HIERARCHICAL TECHNIQUE FOR MECHANICAL THEOREM PROVING AND ITS APPLICATION TO PROGRAMMING LANGUAGE DESIGN
Norman Rubin Nov. 1976 177 p refs
(Contract N00014-75-C-0571)
(AD-A036340; NSO-10) Avail: NTIS HC A09/MF A01 CSCL 09/2

Contents: General Introduction and Review of the Literature; The Theorem Proving System; The Dilemma Programming Language; The Geometry Program; Experimental Results; and Conclusions. GRA

N77-28848# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
A NOTE ON DUALITY IN DISJUNCTIVE PROGRAMMING
Egon Balas Nov. 1976 12 p refs
(Contract N00014-75-C-0621; Grant NSF MPS-73-08534)
(AD-A036399; RR-398; WP-20-76-77) Avail: NTIS HC A02/MF A01 CSCL 12/1

A duality theorem for disjunctive programming is stated, which generalizes to this class of problems the corresponding result for linear programming. Author (GRA)

N77-28849# California Univ., Santa Cruz.
A CONCISE EXTENSIBLE METALANGUAGE FOR TRANSLATOR IMPLEMENTATION
Douglas L. Michels 25 Jul. 1976 29 p refs
(Contract N00014-76-C-0682)
(AD-A036466) Avail: NTIS HC A03/MF A01 CSCL 05/7

A class of emitter augmented phrase structure grammars is defined which can specify simple translations of context free languages. A self-translating metatranslator for the description of these translation grammars is described. Several mutually recursive functions define an interpreter which will execute grammars as translated by this metatranslator. The evolution of more sophisticated translations systems is discussed and extensions to the metatranslator and interpreter are demonstrated. A very concise self-describing metalanguage and an interpreter

which will directly execute its self-description are presented.
Author (GRA)

N77-28850# Northwestern Univ., Evanston, Ill. Center for Mathematical Studies in Economics and Management Science.
THE QUALITY BETWEEN SUBOPTIMIZATION AND PARAMETER DELETION Interim Report
Elmor L. Peterson 22 Feb. 1977 22 p refs
(Grant AF-AFOSR-3134-77)
(AD-A039215; Discussion-Paper-273; AFOSR-77-0629TR)
Avail: NTIS HC A02/MF A01 CSCL 09/2

It is shown that a (sub)optimization over given dual variables effectively deletes the corresponding perturbation parameters of the primal problem -- a fact that has important implications for parametric analysis as well as decomposition theory.
Author (GRA)

N77-28851# Mathematics and Computation Lab., Washington, D. C. Vulnerability Analysis Div.
AGGREGATE: INTERINDUSTRY INPUT-OUTPUT TABLE AGGREGATION PROGRAM Final Report
Tatsuo Okamoto Mar. 1977 27 p Sponsored in part by Federal Preparedness Agency
(PB-265945/6; Program-MR-39) Avail: NTIS HC A03/MF A01 CSCL 05C

Aggregate, a FORTRAN program which enables the user to aggregate the 369-industry level input-output transaction table, to a smaller level table is described. The program is designed to be operated through a standard batch terminal using the Univac 1100 Series Operating System. GRA

N77-28852# Mathematics and Computation Lab., Washington, D. C. Information Science Div.
VULCAN: PROGRAMMER'S REFERENCE MANUAL, REVISION 2 Final Report
Richard H. Vaughan Mar. 1977 71 p Supersedes PB-238182
(PB-265889/6; GSA/FPA/MCL-TM-209-Rev-2) Avail: NTIS HC A04/MF A01 CSCL 09B

The VULCAN programming language is a procedure oriented, recursive string manipulation language. The language includes instructions for operating on strings, an array of strings, and binary integers. Executed on the Univac 1108 as an interpretive processor. VULCAN provides the programmer with advanced string handling capabilities as well as capabilities for self-extension.
GRA

N77-28853# Rensselaer Polytechnic Inst., Troy, N. Y. Computer Research Lab.
PROGRAMMERS MANUAL FOR THE CHAP LINE-DRAWING PROCESSING LANGUAGE
H. Freeman, J. Paolicelli, and M. Potmesil Sep. 1976 85 p refs
(Grants AF-AFOSR-2937-76; AF-AFOSR-2755-75)
(AD-A036391; CRL-52; AFOSR-77-0103TR) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report describes CHAP, a computer language for processing line drawings represented in terms of the 8-direction chain code. The language consists of a set of FORTRAN subroutines, most of which are machine independent. The subroutines may be called by a user program to accomplish specific line-drawing processing tasks. The chain data is stored in packed (machine-dependent) form and is unpacked for processing. The report lists all currently available CHAP subroutines and provides all necessary information for a CHAP programmer. Specific information for different machine implementations are given in the appendices. Implementations exist for IBM 360/370, UNIVAC 1108/1110, CDC 6600, and ADAGE AGT 30/130. Versions for other machines can be readily generated. Author (GRA)

N77-28759*# Naval Research Lab., Washington, D. C.
PURE FIELD THEORIES AND MACSYMA ALGORITHMS
William S. Ament *In* NASA. LANGLEY Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 87-96 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 09B

N77-28761*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
THE EVALUATION OF ATOMIC VARIABLES IN MACSYMA
Jeffrey P. Golden *In* NASA. Langley Res. Center Proc. of 1977 MACSYMA Users' Conf. 1977 p 109-122 refs (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 09B

N77-28769*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
LISP: DATA IS PROGRAM. A TUTORIAL IN LISP
Jon L. White *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 191-202 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 09B

N77-28770*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
DATA REPRESENTATIONS IN PDP-10 MACLISP
Guy Lewis Steele, Jr. *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 203-214 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 09B

N77-28771*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
FAST ARITHMETIC IN MACLISP
Guy Lewis Steele, Jr. *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 215-224 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 09B

N77-28778*# Harvard Univ., Cambridge, Mass. Center for Research in Computing Technology.
AN AUTOMATED CONSULTANT FOR MACSYMA
Michael R. Genesereth *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 309-313 To be presented at 5th Intern. Joint Conf. on Artificial Intelligence Prepared in cooperation with MIT, Cambridge (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 09B

N77-28779*# California Univ., Berkeley.
SOME MACSYMA PROGRAM FOR SOLVING DIFFERENCE EQUATIONS
John Ivie *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 317-326 refs Submitted for publication (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 09B

N77-28785*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
RAY TRAJECTORIES IN A TORUS: AN APPLICATION OF MACSYMA TO A COMPLEX NUMERICAL COMPUTATION
John L. Kulp *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 385-393 refs (For primary document see N77-28750 19-59)
(Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 09B

N77-28790*# Hawaii Univ., Honolulu.
SYMBOLIC COMPUTER VECTOR ANALYSIS
David R. Stoutemyer *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 447-460 refs (For primary document see N77-28750 19-59)
(Grant NSF MCS-75-22893)
Avail: NTIS HC A25/MF A01 CSCL 09B

N77-28791*# Massachusetts Inst. of Tech., Cambridge. Stanford Artificial Intelligence Lab.
A NATURAL WAY TO DO SPATIAL LINEAR GEOMETRY IN MACSYMA
Juan Bulnes *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 461-471 (For primary

document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 09B

N77-28792*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
VARIETIES OF OPERATOR MANIPULATION
Alexander Doohovskoy *In* NASA. Langley Res. Center Proc. of the 1077 MACSYMA Users' Conf. 1977 p 473-490 refs (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks.

N77-28854 Purdue Univ., Lafayette, Ind.
A GRAPH-THEORETIC DECOMPOSITION OF MARKOVIAN NETWORKS Ph.D. Thesis
Dennis Engi 1976 184 p
Avail: Univ. Microfilms Order No. 77-1711

A theory of decomposition is developed that can be used to characterize the tree structure of a directed graph. The networks considered in this dissertation are those arising from finite-state ergodic Markov processes. The decomposition methodology is used to find an algebraic expression of the steady state solution of the entire system in terms of solutions within pieces of the system. To reinforce the theory and to demonstrate its utility, a decomposition algorithm is developed and coded in FORTRAN. The decomposition program was tested against a standard (non-decomposition) program and found to run significantly faster. Computational experience indicates that the decomposition program solves a network problem roughly twice as large as a non-decompositionprogram in the same amount of time.
Dissert. Abstr.

N77-28855# National Bureau of Standards, Washington, D. C. Computer Systems Engineering Div.
COMPUTER SCIENCE AND TECHNOLOGY. COMPUTER NETWORK INTERCONNECTION: PROBLEMS AND PROSPECTS Final Report
Ira W. Cotton Apr. 1977 87 p refs Sponsored by Dept. of Commerce.
(Grant NSF DCR-72-01206-A05)
(PB-265119/8; NBS-SP-500-6; LC-77-608026) Avail: NTIS HC A05/MF A01 CSCL 17B

The interconnection of computer networks is studied with emphasis on Packet Switched Networks (PSNs). Sufficient organizational and technical background is presented to permit an understanding and appreciation of interconnection problems. Four major types of interconnections are then surveyed: (1) circuit switched network to PSN; (2) star network to PSN; (3) simple terminal to PSN; (4) PSN to PSN. The major barriers to interconnection are then outlined. The report concludes with some comments on the prospects for overcoming these barriers. An extensive bibliography, glossary with list of abbreviations, and listing of existing data communications standards revelant to interconnection are also included.
GRA

N77-28856# Pritsker and Associates, Inc., West Lafayette, Ind.
SAINT: A COMBINED DISCRETE/CONTINUOUS NETWORK SIMULATION TECHNIQUE
Deborah J. Seifert (AMRL), David B. Wortman, and Steven D. Duket Apr. 1977 7 p refs Presented at the 8th Ann. Conf. on Modeling and Simulation
(Contract F33615-76-C-5012; AF Proj. 7184; AF Proj. 2313)
(AD-A039586; AMRL-TR-77-24) Avail: NTIS HC A02/MF A01 CSCL 05/8

SAINT, Systems Analysis of Integrated Networks of Tasks, is a network modeling and simulation technique designed to assist in the design and analysis of complex man-machine systems. SAINT provides the conceptual framework for representing systems that consist of discrete task elements, continuous state variables, and interactions between them. It facilitates the assessment of the contribution system components make to overall system performance.
Author (GRA)

N77-28758*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
INDICATOR TENSOR MANIPULATION ON MACSYMA
Richard A. Bogen and Richard Pavelle (Logicon, Inc., Lexington, Mass.) *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 75-85 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 09B

N77-28776*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
USER AIDS FOR MACSYMA
V. Ellen Lewis *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 275-290 ref (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 09B

N77-28777*# Harvard Univ., Cambridge, Mass. Center for Research in Computing Technology.
THE DIFFICULTIES OF USING MACSYMA AND THE FUNCTION OF USER AIDS
Michael R. Genesereth *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 291-308 refs Prepared in cooperation with MIT, Cambridge (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 09B

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N77-28857 California Univ., Los Angeles.
OPTIMAL SWITCHING POLICIES IN A NONHOMOGENEOUS EXPONENTIAL QUEUEING SYSTEM Ph.D. Thesis
William Charles Farrell 1976 98 p
Avail: Univ. Microfilms Order No. 77-1627

A queueing system with two exponential servers operating at different rates is considered. Customers arrive to the service facility according to a Poisson process and are served by one of the two exponential servers. A holding cost is charged for the time that each customer remains in the system (enqueued or in service). The queue controller places customers in service so as to minimize the expected cost to the system of holding customers. Finite horizon problems are considered as well as infinite horizon problems. Policies which minimize total expected discounted future costs and those which minimize average cost per unit time are determined.
Dissert. Abstr.

N77-28858*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE NAVIGATION SYSTEM OF THE JPL ROBOT
Alan M. Thompson 15 Jul. 1977 42 p refs
(Contract NAS7-100)
(NASA-CR-154123; JPL-Publ-77-20) Avail: NTIS HC A03/MF A01 CSCL 09B

The control structure of the JPL research robot and the operations of the navigation subsystem are discussed. The robot functions as a network of interacting concurrent processes distributed among several computers and coordinated by a central executive. The results of scene analysis are used to create a segmented terrain model in which surface regions are classified by traversibility. The model is used by a path planning algorithm, PATH, which uses tree search methods to find the optimal path to a goal. In PATH, the search space is defined dynamically as a consequence of node testing. Maze-solving and the use of an associative data base for context dependent node generation are also discussed. Execution of a planned path is accomplished by a feedback guidance process with automatic error recovery.
Author

N77-28859# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
A SYNTACTIC APPROACH TO TEXTURE ANALYSIS Interim Report

S. Y. Lu and K. S. Fu Feb. 1977 103 p refs
(Grant AF-AFOSR-2661-74)
(AD-A038519; AFOSR-77-0382TR; TR-EE77-14) Avail: NTIS HC A06/MF A01 CSCL 12/2

A syntactic model for the generation of structured texture and for the discrimination of textures is proposed. A texture pattern is first divided into fixed-size windows. Windows belonging to the same texture pattern are then characterized by a tree grammar. This tree grammar is used for synthesis as well as discrimination. If it is considered necessary, distortion or noise is introduced by using stochastic tree grammars. Finally, a set of error-correcting tree automata is used as a texture discriminator. Illustrative examples for texture synthesis and discrimination are presented. Author (GRA)

N77-28860# Purdue Univ., Lafayette, Ind. School of Industrial Engineering.
THE OPTIMAL PLANNING OF COMPUTERIZED MANUFACTURING SYSTEMS. REPORT NO. 4: SIMULATION OF A COMPUTERIZED MANUFACTURING SYSTEM
R. J. Mayer and J. J. Talavage Nov. 1976 155 p refs
(Grant NSF APR-74-15256)
(PB-265118/0; NSF/RA-760453) Avail: NTIS HC A08/MF A01 CSCL 13H

The control logic and material flow in an automated manufacturing facility is examined through the use of a computer simulation. A simulation in GASP 4 was developed, verified, and validated. An experiment was devised to test alternatives to the current design. Results show that: (1) the best parts movement policy allows freedom with respect to subsequent moves; (2) the best temporary storage location is balanced with respect to the traffic of parts in the system; and (3) the best input policy allows the stockpiling of parts with shorter cycle time to prevent interruption of work on parts with longer cycle time. GRA

N77-28861# RAND Corp., Santa Monica, Calif.
IMAGE CORRELATION: PART 1: SIMULATION AND ANALYSIS Interim Report
H. H. Bailey, F. W. Blackwell, C. L. Lowery, and J. A. Ratkovic Nov. 1976 68 p refs
(Contract F44620-73-C-0011)
(AD-A036665; R-2057/1-PR-Pt-1) Avail: NTIS HC A04/MF A01 CSCL 17/7

This report investigates image correlation for map matching in target acquisition and tracking both theoretically and by using computer simulations. The emphasis is on the acquisition phase, particularly (1) the probability of achieving a correct match, (2) selection of an appropriate comparison metric to maximize this probability. Study conclusions: Using methods outlined in this report, an approximate lower bound on the value of the probability of a correct match can be calculated. Several quantitative relationships between this probability and various system parameters have been derived and largely confirmed by simulation testing. The second conclusion is that there ought to be better algorithms than those used in the past. It is reasonable and consistent with theory to search for more efficient ways to carry out the initial map-matching or target-acquisition function. Preprocessing to extract special features using techniques of pattern recognition appear promising for the generation of more efficient algorithms. Future research in this area is outlined. Author (GRA)

N77-28862# RAND Corp., Santa Monica, Calif.
IMAGE CORRELATION. PART 2: THEORETICAL BASIS Interim Report
H. W. Wessely Nov. 1976 34 p ref
(Contracts F49620-77-C-0023; F44620-73-C-0011)
(AD-A036482; R-2057/2-PR-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 17/7

The fundamental nature of the map-matching problem is examined and theoretical justification for using various comparison metrics is investigated. Since the problem is one of statistical decision theory, the optimum solution is to compute the likelihood ratio for each comparison and choose the match point at a place where the likelihood ratio is maximum. That requires a knowledge of N-dimensional joint probability distributions, hence, we resort to approximations that maximize or minimize several functions called 'metrics'. By considering two-picture-element scenes, the features of various metrics are explained and compared with the likelihood ratio. In this way heuristic arguments are developed that support the use of the Product algorithm (a sum of products that is related to classical correlation) when S/N is low, and the MAD algorithm (mean absolute difference) when S/N is high. Author (GRA)

N77-28863# Hawaii Univ., Honolulu. Dept. of Physics and Astronomy.
SELECTION OF VARIABLES IN CLUSTERING AND PATTERN RECOGNITION Final Scientific Report, 1 Jan. 1972 - 31 Dec. 1976
Michael S. Watanabe 31 Mar. 1977 11 p refs
(Grant AF-AFOSR-2259-72)
(AD-A038981; AFOSR-77-0546TR) Avail: NTIS HC A02/MF A01 CSCL 06/4

Activities under the Grant continued and developed the research project under Grant 68-1466, and produced 31 published papers and two accepted papers during this period. These publications are listed at the end of the report, and major results of the research work during this period are all described in the papers. Author (GRA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N77-28864 Wyoming Univ., Laramie.
RIDGE MATRIX INVERSION IN DISCRIMINANT ANALYSIS AND RELATED TOPICS Ph.D. Thesis
Robert Kenneth Smidt 1976 93 p
Avail: Univ. Microfilms Order No. 77-3268

The bias in the roots of a sample covariance matrix was examined. Many statistical techniques involve the use of the roots of sample covariance matrices, and in general, the roots of Wishart matrices. It is demonstrated analytically that for certain cases, the roots are biased and the exact bias is computed for some situations. A Monte Carlo simulation is performed for more general cases and the bias is again apparent. Problems associated with the estimation of the inverse of a covariance matrix from a normal population were explored. The ridge adjusted estimator was applied to discriminant analysis, a commonly applied multivariate technique. It is demonstrated that an improved classification process is obtained. Procedures were developed for classifying a group known to arise from the same population. The results indicate a large amount of similarity between these and the procedures used to classify a single individual. Dissert. Abstr.

N77-28865 Texas Univ., Austin.
CONVERGENCE OF MIXED-HYBRID FINITE ELEMENT METHODS Ph.D. Thesis
June Key Lee 1976 120 p
Avail: Univ. Microfilms Order No. 77-3938

The convergence characteristics of two different types of mixed hybrid finite element methods are studied. The methods are used to solve second order elliptic boundary value problems and certain fourth order problems that arise in mechanics. The methods are based on the idea of embedding the space of admissible functions of a conventional variational boundary value problem into a larger space in which relaxation of certain conventional requirements can be tolerated, and thereby providing greater freedom in constructing finite element subspaces. Because of this property, these methods have definite advantages over the conventional finite element method for high order and singular problems. One shortcoming of the methods is the loss of the convenient extremum property of the associated functionals, and this makes the convergence characteristics delicate. Dissert. Abstr.

N77-28866*# Aeronautical Research Associates of Princeton, Inc., N. J.
COMPUTER TRANSFORMATION OF PARTIAL DIF-

FERENTIAL EQUATIONS INTO ANY COORDINATE SYSTEM
Roger D. Sullivan Jun. 1977 41 p refs
(Contract NAS2-8014)
(NASA-CR-152020; ARAP-309) Avail: NTIS HC A03/MF A01 CSCL 12A

The use of tensors to provide a compact way of writing partial differential equations in a form valid in all coordinate systems is discussed. In order to find solutions to the equations with their boundary conditions they must be expressed in terms of the coordinate system under consideration. The process of arriving at these expressions from the tensor formulation was automated by a software system, TENSR. An allied system that analyzes the resulting expressions term by term and drops those that are negligible is also described. Author

N77-28867*# Mississippi State Univ., Mississippi State. Dept. of Aerophysics and Aerospace Engineering.
TWO-BODY COORDINATE SYSTEM GENERATION USING BODY-FITTED COORDINATE SYSTEM AND COMPLEX VARIABLE TRANSFORMATION M.S. Thesis
Walter Serrill Long Aug. 1977 61 p refs
(Grant NGR-25-001-055)
(NASA-CR-153934) Avail: NTIS HC A04/MF A01 CSCL 12A

Attempts are made to generate acceptable coordinate systems for two-body configurations. The first method to be tried was to use the body-fitted coordinate system technique to obtain the best system. This technique alone did not produce very good results, so another approach was investigated. This new approach involved using a combination of the body fitted coordinate system procedure and a complex variable transformation method that was used successfully in conformal mapping. Author

N77-28868*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LEAST SQUARES POLYNOMIAL FITS AND THEIR ACCURACY
William M. Lear (TRW Systems Group) Jun. 1977 24 p
(NASA-TM-74769; JSC-12915; Rept-77-FM-32) Avail: NTIS HC A02/MF A01 CSCL 12A

Equations are presented which attempt to fit least squares polynomials to tables of date. It is concluded that much data are needed to reduce the measurement error standard deviation by a significant amount, however at certain points great accuracy is attained. L.S.

N77-28869# Sandia Labs., Albuquerque, N. Mex.
THE CDC 6600 SUBROUTINES FOR BESSEL FUNCTIONS J NU(x), x GREATER THAN OR EQUAL TO 0, NU GREATER THAN OR EQUAL TO 0 AND AIRY FUNCTIONS Ai(x), Ai PRIME(x), - INFINITY < x < INFINITY
D. E. Amos, Sharon L. Daniel, and M. Katherine Weston Sep. 1976 38 p refs
(Contract EY-76-C-04-0789)
(SAND-75-0147) Avail: NTIS HC A03/MF A02

Subroutine BESJ implements the power series, the asymptotic expansion for x yields infinity and the uniform asymptotic expansion for v yields infinity for J/sub v/(x). In the region $x < v$ forward recursion is stable, and values from the asymptotic expansion for x yields infinity with small v are used to start the recursion for $x < 20$. Except for $x < 1/2$ where the series is used, the Miller backward recursive algorithm, normalized by the power series for the expansion for v yields infinity, is utilized to compute sequences of Bessel functions and cover other parts of the (v,x) plane where no normalization expression is available. The normalization is always computed first with the leading term tested for underflow before any extensive computation is done. Chebyshev expansions on appropriate intervals are used in functions AIRY and DAIRY for the Airy functions (Ai(x) and Ai'(x), respectively. A scaling option to remove the exponential decay for $x < 0$ is also available. Author

N77-28870# Rice Univ., Houston, Tex. Aero-Astronautics Group.
SOME PHILOSOPHICAL VIEWS OF ALGORITHMS AND COMPUTING METHODS IN APPLIED MATHEMATICS
Angelo Miele Sep. 1976 28 p refs Presented at the Workshop on Decision Inform. for Tactical Command and Control, Airlie, Va., 22-25 Sep. 1976
(Grant AF-AFOSR-3075-76; AF Proj. 2304)
(AD-A038921; AAR-136; AFOSR-77-0516TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper summarizes some of the work done by the Aero-Astronautics Group of Rice University in the area of numerical methods and computing methods. It describes some of the philosophical thoughts that have guided this work throughout the years. Recommendations are offered concerning allocation of funds and distribution of funds. Additional recommendations are offered in order to bridge the gap between the top management of government agencies and the academic community.
Author (GRA)

N77-28871# Stanford Univ., Calif. Dept. of Computer Science.
DETERMINING THE STABILITY NUMBER OF A GRAPH
V. Chavatal Dec. 1976 42 p refs
(Contract N00014-76-C-0330; Grant NSF MCS-72-03752)
(AD-A038864; SU-STAN-CS-76-583) Avail: NTIS HC A03/MF A01 CSCL 12/1

Certain rules for deriving upper bounds on the stability number of a graph are formalized. The resulting system is powerful enough to (1) encompass the algorithms of Tarjan's type and (2) provide very short proofs on graphs for which the stability number equals the clique-covering number. However, the main result shows that for almost all graphs with a (sufficiently large) linear number of edges, proofs within the system must have at least exponential length. GRA

N77-28872# Texas Christian Univ., Fort Worth. Inst. of Behavioral Research.
APPLICATIONS OF TWO-STAGE LEAST SQUARES IN CAUSAL ANALYSIS AND STRUCTURAL EQUATIONS
Lawrence R. James and B. Krishna Singh 11 Mar. 1977 93 p refs
(Contract N00014-76-C-0008)
(AD-A038348; IBR-77-6) Avail: NTIS HC A05/MF A01 CSCL 12/1

A procedure, two-stage least squares (2SLS), for analyzing structural equations when one or more explanatory variables are correlated with the error or disturbance term is reviewed. A brief introduction to structural equations and the use of ordinary least squares in causal analysis is presented initially. This is followed by an introduction of 2SLS and the application to 2SLS to designs in which: (1) two or more variables are reciprocal causes of each other, (2) one or more variables contain random measurement error, and (3) lagged values of one or more dependent variables are used as predictors. A major objective for the review of these particular applications of 2SLS is to demonstrate how salient problems in psychology can be addressed by use of structural equations. Author (GRA)

N77-28873# Wisconsin Univ., Madison. Mathematics Research Center.
THE NUMERICALLY STABLE RECONSTRUCTION OF A JACOBI MATRIX FROM SPECTRAL DATA
C. DeBoor and G. H. Golub Feb. 1977 21 p refs
(Contracts DAAG29-75-C-0024; AT(04-3)-326)
(AD-A038960; MRC-TSR-1727) Avail: NTIS HC A02/MF A01 CSCL 12/1

A stable algorithm is given for the construction of a symmetric tridiagonal matrix of order n from its eigenvalues and the eigenvalues of its upper left principal submatrix of order n - 1. The algorithm might be of help in the approximate solution of inverse eigenvalue problems for Sturm-Liouville equations.
Author (GRA)

N77-28874# Wisconsin Univ., Madison. Mathematics Research Center.
ORTHOGONAL POLYNOMIALS
Paul G. Nevai Feb. 1977 121 p refs
(Contract DAAG29-75-C-0024; Grant NSF MPS-75-06687)
(AD-A038959; MRC-TSR-1726) Avail: NTIS HC A06/MF A01 CSCL 12/1

The purpose of the present paper is to improve some results on orthogonal polynomials, Christoffel functions, orthogonal Fourier

series, eigenvalues of Toeplitz matrices, and Lagrange interpolation. In particular, the problem is of there being any weight w with compact support such that for each p=2 the Lagrange interpolating polynomials corresponding to w diverge in Lpw for some continuous function f will be answered. Most of the paper deals with Christoffel functions and their applications. Many limit relations for orthogonal polynomials are found in the assumption that the coefficients in the recursion formula behave nicely. GRA

N77-28875# Wisconsin Univ., Madison. Mathematics Research Center.

NEW VARIATIONAL BOUNDS ON GENERALIZED POLARIZABILITIES

Peter D. Robinson Feb. 1977 25 p refs
(Contract DAAG29-75-C-0024)
(AD-A038958; MRC-TSR-1725) Avail: NTIS HC A02/MF A01 CSCL 12/1

New variational bounds are derived on the generalized polarizabilities of a quantum-mechanical system, for arbitrary complex frequencies zeta=nu-i omega and two different perturbations u and v. No power of the Hamiltonian h higher than h squared is involved in the bounding functionals. For a certain range of nu-values, upper and lower bounding functionals are obtained which contain merely a single trail vector but also introduce an inverse operator like 1/h. This impractical feature can be avoided with a subsidiary variational principle, leading to bivariational upper and lower bounds. Explicit bivariational bounds are also derived which are valid for all values of zeta. Both theoretical and practical aspects of the bounds are discussed. Author (GRA)

N77-28876# Wisconsin Univ., Madison. Mathematics Research Center.

MAXIMUM LIKELIHOOD ESTIMATION OF MULTIVARIATE AUTOREGRESSIVE-MOVING AVERAGE MODELS

M. S. Phadke and G. Kedem Feb. 1977 22 p refs
(Contract DAAG29-75-C-0024)
(AD-A038955; MRC-TSR-1722) Avail: NTIS HC A02/MF A01 CSCL 12/1

Algorithms for computing the exact likelihood function of n successive observation vectors from an s-variate autoregressive moving average process of order (P,Q) are developed. A quasi-Newton method is used to maximize the likelihood function with respect to the parameters of the process. Monte Carlo simulations are performed to compare the parameter estimates obtained by maximizing the exact likelihood function versus those obtained by maximizing various approximate forms of the likelihood function. Author (GRA)

N77-28877# Wisconsin Univ., Madison. Mathematics Research Center.

SOME FINITE DIMENSIONAL INTEGRABLE SYSTEMS AND THEIR SCATTERING BEHAVIOR

Mark Adler Feb. 1977 74 p refs
(Contracts DAAG29-75-C-0024; N00014-76-C-0301)
(AD-A038952; MRC-TSR-1718) Avail: NTIS HC A04/MF A01 CSCL 12/1

Integrable Hamiltonian systems and also systems whose Hamiltonians are integrals of these are discussed. The derivation of the results is made possible by the fact that the equations of motion can be interpreted as deformation equations for matrix functions whose spectrum remains fixed as the system evolves in time, leading both to integrals of the motion, and a description of the solution. GRA

N77-28878# Wisconsin Univ., Madison. Mathematics Research Center.

STATIONARY PATTERNS FOR REACTION-DIFFUSION EQUATION

Paul C. Fife Jan. 1977 53 p refs
(Contract DAAG29-75-C-0024; Grant NSF MPS-74-06835)
(AD-A038943; MRC-TSR-1709) Avail: NTIS HC A04/MF A01 CSCL 12/1

Patterns are defined to be stable stationary nonconstant solutions of the equations of reaction and diffusion. Several approaches are used to show the existence (or nonexistence) of patterns depending on one variable and defined on the entire real line. For a scalar equation, it is shown that there are essentially no patterns. For a system, small amplitude patterns, larger amplitude peaks, and larger amplitude plateaus are treated. In all cases, stability is an important consideration. Applications to ecology and biophysics are mentioned. Author (GRA)

N77-28879# Wisconsin Univ., Madison. Mathematics Research Center.

ON A THEOREM OF VOLOSIN CONCERNING ENUMERATION OF FUNCTION COMPOSITIONS

Bernard Harris Dec. 1976 16 p
(Contract DAAG29-75-C-0024)
(AD-A038942; MRC-TSR-1708) Avail: NTIS HC A02/MF A01 CSCL 12/1

The purpose of this paper is to present a direct and simpler combinatorial proof of a theorem of Yu. M. Volosin on the enumeration of function compositions and to exhibit some of the consequences of this theorem. Many consequences are stated in the paper of Volosin; however, his methods are relatively retractable. Here is obtained a generating function which facilitates enumeration. The methods and arguments employed here should be compared with Volosin. The combinatorial structure enumerated here is a fairly general one with many applications, only a few of which are provided in the present paper. GRA

N77-28880# Technology Service Corp., Santa Monica, Calif.

REPRO-MODELING APPLIED TO THE SIMPLIFICATION OF TARADCOM COMPUTER MODELS Final Report

Gene B. Goldstein and Theodore Dushane Dec. 1976 143 p refs
(Contract DAAE07-76-C-0105)
(AD-A038740; TSC-PD-A156-1; TARADCOM-TR-12242) Avail: NTIS HC A07/MF A01 CSCL 12/1

As mathematical models become large and complex, they become more difficult to apply and understand. Repro-modeling is a technique for constructing an efficient input/output approximation to a complex model. The technique is founded upon an economical representation for continuous piecewise linear functions of many input variables. Repro-modeling as described here is the fitting of input/output data by a continuous piecewise linear function. A software package called COMPLIAR which accomplishes this is described, and the theory underlying its use is explained. Instructions for the use of the software and examples are included. Author (GRA)

N77-28881# ARO, Inc., Arnold Air Force Station, Tenn.

SMOOTHING TECHNIQUE AND VARIANCE PROPAGATION FOR ABEL INVERSION OF SCATTERED DATA Final Report, Jan. 1975 - Jun. 1976

R. T. Shelby and C. C. Limbaugh Apr. 1977 105 p
(AD-A038495; ARO-ETF-76-126) Avail: NTIS HC A06/MF A01 CSCL 20/14

An analytic method of performing Abel inversions and subsequent analysis of the propagated experimental errors is described. The Abel inversion is applied to the problem of determining the radial distribution of emission coefficients from measurements of the radiance from a cylindrically symmetric radiating source. The particular scheme investigated is a least-squares polynomial spline fit technique. GRA

N77-28882# Stanford Univ., Calif. Dept. of Operations Research.

A THEORY FOR SEMI-MARKOV DECISION PROCESSES WITH UNBOUNDED COSTS AND ITS APPLICATION TO THE OPTIMAL CONTROL OF QUEUEING SYSTEMS

Peter Orkenyi Aug. 1976 82 p refs
(Contract N00014-76-C-0418; Grant NSF ENG-75-14847; NR Proj. 047-061)
(AD-A030649; SU-TR-64) Avail: NTIS HC A05/MF A01 CSCL 12/2

Semi-Markov decision processes with countable state and action spaces are investigated. The optimality criteria considered are the average cost criterion, the undiscounted cost criterion, and the discounted cost criterion. The common assumption of bounded costs has been replaced by some considerably weaker conditions. In particular, our assumptions are weaker than those made by Harrison, Hordijk, Lippman and Reed when they considered the same problem. The existence of optimal, stationary

optimal and stationary E-optimal policies is investigated. Policy improvement is considered. Necessary and sufficient conditions for the optimality of a policy are given. Then the optimal control of queueing systems is considered by formulating this general problem as a semi-Markov decision process. Finally, four different ways of proving the optimality of an unimprovable policy are developed in the context of queueing systems. Author (GRA)

N77-28883# Naval Postgraduate School, Monterey, Calif.
DISCRETE TIME SERIES GENERATED BY MIXTURES. 1: CORRELATIONAL AND RUNS PROPERTIES
P. A. W. Lewis and P. A. Jacobs Jan. 1977 41 p refs Sponsored in part by NSF
(AD-A039467; NPS55-77-1) Avail: NTIS HC A03/MF A01 CSCL 12/1

A broad but parametrically simple model for a stationary sequence of dependent discrete random variables is given and several submodels are discussed. The structure of the model is specified by the marginal distribution of the random variables and several other parameters. The sequence of random variables is formed by a probabilistic linear combination of independent, identically distributed discrete random variables and is in general not Markovian. Second-order joint moments and spectra are obtained for the model, as well as some properties for the lengths of runs. The special case of process in which the variables take on only two values is useful as a model for the counting process in a discrete-time point process. An application to the modelling of errors in the transmission of binary data is briefly discussed.
Author (GRA)

N77-28884# Naval Postgraduate School, Monterey, Calif.
DETERMINATION OF HYPOTHESIS TESTABILITY IN LINEAR STATISTICAL MODELS M.S. Thesis
William Hammond Walls Mar. 1977 51 p refs
(AD-A039951) Avail: NTIS HC A04/MF A01 CSCL 12/1

Analysts conducting experiments must frequently deal with situations in which data is incomplete or missing. This creates problems that can seriously affect classical hypothesis testing by introducing extraneous terms into the hypothesis in a complicated way. A technique exists that allows an analyst to determine precisely which experimental terms are actually present in a proposed hypothesis and what that hypothesis would actually be testing if employed. This paper examines the mathematics underlying the technique and applies the theory to a widely used data analysis computer package. A computer program is presented to facilitate implementation of the method.
Author (GRA)

N77-28751*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
MACSYMA'S SYMBOLIC ORDINARY DIFFERENTIAL EQUATION SOLVER
Jeffrey P. Golden *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 1-10 refs (For primary document see N77-28750 19-64)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28752*# Hawaii Univ., Honolulu.
A PROGRAM FOR THE SOLUTION OF INTEGRAL EQUATIONS
Richard A. Bogen *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 11-19 refs (For primary document see N77-28750 19-59)
(Grant NSF MC-575-22983)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28753*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
SYMBOLIC LAPLACE TRANSFORMS OF SPECIAL FUNCTIONS
Yannis Avgoustis *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 21-41 refs (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28754*# California Univ., Berkeley.
AN IMPROVED ALGORITHM FOR THE ISOLATION OF POLYNOMIAL REAL ZEROS
Richard J. Fateman *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 43-54 refs (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28755*# Massachusetts Inst. of Tech., Cambridge. Lab. of Computer Science.
PRESERVING SPARSENESS IN MULTIVARIATE POLYNOMINAL FACTORIZATION
Paul S. Wang *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 25-64 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28756*# IBM Watson Research Center, Yorktown Heights, N.Y. Mathematical Sciences Dept.
ON THE EQUIVALENCE OF POLYNOMIAL GCD AND SQUAREFREE FACTORIZATION PROBLEMS
David Y. Y. Yun *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 65-70 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28757*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIFFERENTIAL FORM ANALYSIS USING MACSYMA
Hugo D. Wahlquist *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 71-74 refs (For primary document see N77-28750 19-59)
(Contract NAS7-100)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28762*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
THE VARIETY OF VARIABLES IN MATHEMATICAL EXPRESSIONS
Joel Moses *In* NASA. Langley Res. Center Pro. of the 1977 MACSYMA Users' Conf. 1977 p 123-144 (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28763*# Naval Ship Research and Development Center, Annapolis, Md.
RATIONAL APPROXIMATION TO e TO THE -x POWER WITH NEGATIVE POLES
Elizabeth Cuthill *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 131-144 refs (For primary document see N77-28750 19-59)
HC A25/MF A01 CSCL 12A

N77-28764*# College of William and Mary, Williamsburg, Va.
TIMING FORMULAS FOR DISSECTION ALGORITHMS ON VECTOR COMPUTERS
W. G. Poole, Jr. *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 145-150 refs (For primary document see N77-28750 19-59)
(Contracts NAS1-14101; N00014-75-C-0879)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28765*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SYMBOLIC CALCULATIONS IN A FINITE DYNAMIC ELEMENT ANALYSIS
Kajal K. Gupta and Edward W. Ng *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 151-159 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28767*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OBSERVATIONS ON APPROXIMATE INTEGRATIONS
Edward W. Ng *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 177-180 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28772*# Toronto Univ. (Ontario). Div. of Physical Sciences.
ON COMPUTING CLOSED FORMS FOR SUMMATIONS
Robert Moenck *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 225-236 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28773*# Xerox Corp., Palo Alto, Calif. Air Research Center.
INDEFINITE HYPERGEOMETRIC SUMS IN MACSYMA
R. Wm. Gosper, Jr. *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 237-251 refs Sponsored in part by NSF (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28774*# Rensselaer Polytechnic Inst., Troy, N. Y.
MODULAR POLYNOMIAL ARITHMETIC IN PARTIAL FRACTION DECOMPOSITION
S. K. Abdali, B. F. Caviness, and A. Pridor *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 253-261 refs (For primary document see N77-28750 19-59)
(Grant NSF MCS-76-23762)
Avail: NTIS HC A35/MF A01 CSCL 12A

N77-28775*# Universidad Boliviana Mayor de San Simon, Cochabamba.
A NEW ALGORITHM FOR THE INTEGRATION OF EXPONENTIAL AND LOGARITHMIC FUNCTIONS
Michael Rothstein *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 263-274 refs (For primary document see N77-28750 19-59)
(Grants NSF MCS-76-23762; NSF-GU-32181; NSF MCS-76-15035)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28780*# California Univ., Berkeley.
SOME COMMENTS ON SERIES SOLUTIONS
Richard J. Fateman *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p327-346 refs (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28781*# Mitre Corp., Bedford, Mass.
POWER SERIES SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS IN MACSYMA
Edward L. Lafferty *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 347-360 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28782*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
RADICAL SIMPLIFICATION MADE EASY
Richard E. B. Zippel *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 361-367 refs (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28784*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics and Plasma Fusion Center.
REDUCTION OF THE EQUATION FOR LOWER HYBRID WAVES IN A PLASMA TO A NONLINEAR SCHROEDINGER EQUATION
Charles F. F. Karney *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 377-383 refs (For primary document see N77-28750 19-59)
(Contract E(11-1)-3070; Grant NSF ENG-76-06242)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28787*# Waterloo Univ. (Ontario).
SYMBOLIC COMPUTATION OF RECURRENCE EQUATIONS FOR THE CHEBYSHEV SERIES SOLUTION OF LINEAR ODE'S
K. O. Geddes *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 405-423 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28788*# Hawaii Univ., Honolulu.
SIN(X)2 + COS(X)**2 = 1**
David R. Stoutemyer *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 425-433 refs (For primary document see N77-28750 19-59)
(Grant NSF MC5-75-22893)
Avail: NTIS HC A25/MF A01 CSCL 12A

N77-28789*# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science and Mathematics.
MATRIX COMPUTATIONS IN MACSYMA
Paul S. Wang *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 435-446 refs (For primary document see N77-28750 19-59)
(Grant NsG-1323; Contract E(11-1)-3070)
Avail: NTIS HC A25/MF A01 CSCL 12A

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N77-28885 Iowa State Univ. of Science and Technology, Ames.
ASPECTS OF QUADRATIC PROGRAMMING WITH STATISTICAL APPLICATIONS Ph.D. Thesis
Rebecca Jane Klemm 1976 151 p
Avail: Univ. Microfilms Order No. 77-1457

The concept of closed form least squares solutions is extended to closed form least squares solutions over inequality constraints. Closed form solutions are derived for several types of models classified as quadratic programming problems. These models include linear interval constraints as well as linear inequality constraints. Typical duality theory is related to the determination of a saddle point of a given Lagrangian function. The bias and mean square error of the closed form estimators is also considered. Finally, a generalized upper bounding algorithm is developed to solve a general class of quadratic programming problems. This algorithm reduces the size of the basic matrix so that the total number of computations is greatly reduced compared to other standard quadratic programming procedures. Dissert. Abstr.

N77-28886 Georgia Univ., Athens.
MULTI-STAGE SAMPLING ON SUCCESSIVE OCCASIONS Ph.D. Thesis
Dharam Singh Rana 1976 159 p
Avail: Univ. Microfilms Order No. 77-4155

Three stage successive sampling was investigated from the design point of view. Out of a possible set of 12, four sampling procedures were selected. General linear unbiased estimators of the population mean on second occasion, the change between first and second occasion, overall mean for two occasions, and the joint estimates of mean and change were developed for each of the four chosen procedures. The optimum weights and the variances of these estimators were obtained under some simplifying assumptions. The statistical efficiencies of the estimators were studied numerically for some selected values of the parameters and the design quantities involved in the formulae of the relative efficiencies. The optimum allocation of sample for a given cost was also discussed for the special case of estimating the current population mean in two stage successive sampling. Dissert. Abstr.

N77-28887 Texas A&M Univ., College Station.
SOME PROBLEMS OF STATISTICAL INFERENCE IN REGRESSION AND DISCRIMINANT ANALYSIS Ph.D. Thesis
Violeta Amelia Sonvico 1976 137 p
Avail: Univ. Microfilms Order No. 77-2671

Discrimination between two multivariate populations can be done with the same discriminant function if the vector of mean difference is proportional. A likelihood ratio test is derived for testing this hypothesis. The problem of analysis of association

between two attributes A and B in a contingency table can be handled with the help of canonical analysis of two vectors. Whether this association is linear or not and if it is linear, whether a proposed set of scores are adequate for this purpose can be tested by using the classical multivariate criteria. Dissert. Abstr.

N77-28888 Colorado State Univ., Fort Collins.
LIMITING DISTRIBUTIONS IN STORAGE THEORY Ph.D. Thesis
Brent Monroe Troutman 1976 173 p
Avail: Univ. Microfilms Order No. 77-3064

The limiting distributions for various random quantities of interest in reservoir storage theory were derived, utilizing the theory of weak convergence of random elements and random walk theory. These random quantities were studied within the framework of three theoretical models: the infinite reservoir, the semi-infinite reservoir, and the finite reservoir. The levels in the first constituted an unrestricted random walk process (in discrete time), the levels in the second, a random walk restricted by a single reflecting barrier, and the levels in the third a random walk with two reflecting barriers. The range, defined for the infinite reservoir, and the maximum accumulated deficit, for the semi-infinite reservoir, were the most important random variables investigated, though the same principles were also applied in studying several other quantities, such as the occupation time. Dissert. Abstr.

N77-28889 Texas A&M Univ., College Station.
A SUPER-POPULATION APPROACH TO MULTI-STAGE SAMPLING Ph.D. Thesis
Richard Keith Burdick 1976 94 p
Avail: Univ. Microfilms Order No. 77-2599

A technique for the estimation of finite population parameters in a multistage sample survey was described. Specifically, estimators and confidence intervals for parameters of the finite population were developed for two stage sampling. The stochastic procedure generating the sample is assumed to be a two step procedure. The first step is selection of a 'large sample' from an infinite superpopulation and the second step is the actual implementation of the sample survey. Dissert. Abstr.

N77-28890 Johns Hopkins Univ., Baltimore, Md.
LIKELIHOOD TECHNIQUES FOR DISCRETE DISTRIBUTIONS Ph.D. Thesis
Jeannette Yen Lee 1977 340 p
Avail: Univ. Microfilms Order No. 77-7743

Binomial, Poisson and hypergeometric probability models are widely used to describe discrete data. Likelihood functions were studied under these models to determine sets of parameter points which are well supported by the data. Approximations to the binomial and Poisson support intervals are discussed from two viewpoints. The concept of asymptotic equivalence of likelihoods is introduced here so that asymptotic approximations may be considered and implications of the square root and logarithmic transformations and their variants on the support interval are also investigated. Examples are presented which include classic sets of epidemiological data. Two types of support intervals for the hypergeometric distribution are discussed. Intervals for both K (the number of defectives in a population of known size N) and for N (the population size with a known number of defectives K) are obtained when the sample size is fixed and the number of defectives in the sample is known. Dissert. Abstr.

N77-28891# Wisconsin Univ., Madison. Mathematics Research Center.
AN EMPIRICAL BAYES APPROACH TO OUTLINERS
Enrique DeAlba and J. Van Ryzin Mar. 1977 32 p refs
(Contracts DAAG29-75-C-0024; Contracts PHS-CA-18332)
(AD-A038966; MRC-TSR-1734) Avail: NTIS HC A03/MF A01 CSCL 12/1

A formulation of the problem of detecting outliers as an empirical Bayes problem is studied. In so doing what arises is a non-standard empirical Bayes problem for which the notion of Average Risk Asymptotic Optimality (A.R.A.O.) of procedures is defined. Some general theorems giving sufficient conditions for A.R.A.O. procedures are developed. These general results are then used in various formulations of the outlier problem for underlying normal distributions to give A.R.A.O., empirical Bayes procedures. GRA

N77-28892# Indiana Univ., Bloomington. Dept. of Mathematics.
A ROBUST SPHERICAL CORRELATION COEFFICIENT AGAINST SCALE Interim Report
Kanti V. Mardia and Madan L. Puri 1977 13 p refs
(Grant AF-AFOSR-2927-76; AF Proj. 2304)
(AD-A038785; AFOSR-77-0447TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

There are several bi-directional situations where it is required to obtain a measure of correlation. The question has been raised often that the bi-directional correlation coefficients so far known are not scale invariant even asymptotically. Following Cox's procedure (Cox, J. Roy. 1975, Statist. Soc. B, 380-381), a new correlation coefficient is introduced which has the desirable property of being invariant under scale for large samples with von Mises marginals. Its asymptotic distribution under the hypothesis of independence is obtained and examined. GRA

N77-28893# North Carolina Univ., Chapel Hill. Dept. of Statistics.
WEAK CONVERGENCE OF SOME QUANTILE PROCESSES ARISING IN PROGRESSIVELY CENSORED TESTS
Pranab Kumar Sen Oct. 1976 33 p refs
(Grant AF-AFOSR-2736-74)
(AD-A036392; Mimeo-Ser-1092; AFOSR-77-0108TR) Avail: NTIS HC A03/MF A01 CSCL 21/5

For progressive censoring schemes pertaining to a general class of (parametric as well as nonparametric) testing situations, one encounters a (partial) sequence of linear combinations of functions of order statistics where the coefficients are themselves stochastic variables. Weak convergence of such a quantile process to an appropriate Gaussian function is studied here, and the same is incorporated in the formulation of suitable (time -) sequential tests based on these quantile processes. Author (GRA)

N77-28894# North Carolina Univ., Chapel Hill. Dept. of Biostatistics.
NONPARAMETRIC TESTS FOR MULTIPLE REGRESSION UNDER PROGRESSIVE CENSORING Interim Report
Hiranmay Majumdar and Pranab Kumar Sen 1976 37 p refs
(Contract PHS-NHLI-71-2243; Grant AF-AFOSR-2736-74; AF Proj. 2304)
(AD-A036398; AFOSR-77-0105TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

For continuous observations from time-sequential studies, suitable Cramer-von Mises and Kolmogorov-Smirnov type (nonparametric) statistics (based on linear rank statistics) for testing hypotheses on some multiple regression models are proposed and studied. Asymptotic theory of these tests is provided for both the null and (local) alternative hypotheses situations and is based on the weak convergence of suitable rank order processes (on the D(0,1) space) to certain functions of Brownian Motions. Bahadur efficiency results are also presented. Empirical values of the percentile points of the null distributions of the proposed test statistics, obtained through simulation studies, are also provided. Author (GRA)

N77-28895# North Carolina Univ., Chapel Hill. Dept. of Biostatistics.
ASYMPTOTICALLY DISTRIBUTION-FREE ALIGNED RANK ORDER TESTS FOR COMPOSITE HYPOTHESES FOR GENERAL MULTIVARIATE LINEAR MODELS
Pranab Kumar Sen and Madan L. Puri 1976 18 p
(Contract AF-AFOSR-2736-74)
(AD-A036396; AFOSR-77-0106TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

For general multivariate linear models, a composite hypothesis does not usually induce invariance of the joint distribution under appropriate groups of transformations, so that genuinely distribution-free tests do not usually exist. For this purpose, some aligned rank order statistics are incorporated in the proposal and study of a class of asymptotically distribution-free tests. Tests for the parallelism of several multiple regression surfaces

are also considered. Finally the optimal properties of these tests are discussed. Author (GRA)

N77-28896# Syracuse Univ., N. Y.
NOMOGRAMS FOR THE DESIGN OF SINGLE SAMPLE RELIABILITY ACCEPTANCE PLANS FOR EXPONENTIAL DISTRIBUTION Final Technical Report, Aug. 1975 - Oct. 1976
Amrit L. Goel and Anand M. Joglekar Griffiss AFB, N. Y. RADC Jan. 1977 28 p refs
(Contract F30602-71-C-0312)
(AD-A036654; Rept-76-6; RADC-TR-77-11) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report presents nomograms for the design and evaluation of single sample reliability acceptance tests for exponential distribution. The nomograms permit an exploration of the design region and facilitate the examination of alternative solutions and their implications. The nomograms constitute a useful tool for the practicing engineer to weigh the trade-offs between design and test criteria. Several examples are presented to illustrate the use of the nomograms toward plan design, exploration of the design region, examination of the effects of changes in design criteria on the designed plans, design with engineering constraints and design with partial information. Author (GRA)

N77-28897# North Carolina Univ., Chapel Hill. Dept. of Statistics.
CONDITIONS FOR THE CONVERGENCE IN DISTRIBUTION OF MAXIMA OF STATIONARY NORMAL PROCESSES
M. R. Leadbetter, G. Lindgren (Umea Univ., Sweden), and H. Rootzen May 1977 14 p refs
(Contract N00014-75-C-0809)
(AD-A040069) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this report the standard (Berman) conditions for the validity of the asymptotic distribution for the maximum of a normal process are further weakened, to become even closer to necessity. Both discrete and continuous parameter cases are considered. Author (GRA)

N77-28898# Naval Postgraduate School, Monterey, Calif.
ASYMPTOTIC EFFICIENCY AND SOME QUASI-METHOD OF MOMENTS ESTIMATORS
Robert Read 15 Mar. 1977 76 p refs
(AD-A039468; NPS55-77-7) Avail: NTIS HC A05/MF A01 CSCL 12/1

The report contains the asymptotic efficiencies of some candidate estimators which provide alternatives to maximum likelihood in some common probabilistic settings. The alternative estimators can be found with measurably less effort than solving the likelihood equations. They include the method of moments and similarly constructed estimators that involve the harmonic mean. The most successful example found deals with the negative binomial distribution. Here, the harmonic mean estimator has high efficiency in regions where the method of moments estimator has rather low efficiency. Author (GRA)

N77-28899# Naval Postgraduate School, Monterey, Calif.
A GENERALIZED MAXIMUM ENTROPY PRINCIPLE FOR DECISION ANALYSIS
Marlin U. Thomas Apr. 1977 26 p refs
(AD-A039926; NPS55-77-20) Avail: NTIS HC A03/MF A01 CSCL 12/2

A generalized maximum entropy principle is described for dealing with decision problems involving uncertainty but with some prior knowledge about the probability space corresponding to nature. This knowledge about the probabilistic structure is expressed through known bounds on event probabilities and moments, which is incorporated into a nonlinear programming problem. The solution provides a maximum entropy distribution which is then used in treating the decision problem as one involving risk. An example application is described that involves the selection of oil spill recovery systems for inland harbor regions. Other areas of application are identified and tables of some maximum entropy distributions resulting from a variety of moment constraints are provided. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N77-28900 Kent State Univ., Ohio.
THE SET CONSTRAINED LOCATION-ALLOCATION PROBLEM Ph.D. Thesis
Thomas Michael Gunther 1976 341 p
Avail: Univ. Microfilms Order No. 77-3828

The solution of the set constrained location-allocation problem is sought using two methods. The first is a heuristic, which iteratively locates and allocates until no reduction in the value of the objective function can be found. At the end of either phase for any iteration, the heuristic yields feasible solutions in which the allocation (location) is optimal given the location (allocation). At termination, the solutions are good to optimal. The second approach is based on the partial Lagrangian relaxation of the zero-one integer programming formulation of the set constrained location-allocation problem. The sub-gradient technique is applied to this relaxation in an iterative scheme which seeks to maximize the value of the Lagrangian dual of the relaxation. The results indicate that the approach is useful for small or important problems, and that by manipulation of the manner in which the stepsize is computed, excellent results are obtainable. Finally, the heuristic is applied to a real world example of the set constrained location-allocation problem. Dissert. Abstr.

N77-28901 Kent State Univ., Ohio.
MATHEMATICAL PROGRAMMING APPROACHES TO SOLVING SPATIAL EQUILIBRIUM AND ALLOCATION MODELS Ph.D. Thesis
Richard Floyd Deckro 1976 107 p
Avail: Univ. Microfilms Order No. 77-3823

The formulation and justification of several mathematical programming forms for the solution of the spatial equilibrium problem is considered. This problem may be summarized as the establishment of regional demand and supply prices and trade flows in a spatially separated economy. The 'primal-dual' transportation formulation outlined by Casetti is augmented to account for several mathematically feasible solutions which are economically meaningless. This augmented model is then utilized to develop a series of quadratic programming approaches to solving the spatial equilibrium problem. The quadratic programming model is then utilized to develop a linear programming model to establish spatial equilibrium prices and flows. Dissert. Abstr.

N77-28902# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
FINITE MEMORY ESTIMATION AND CONTROL OF FINITE PROBABILISTIC SYSTEMS Ph.D. Thesis
Loren Kerry Platzman Jan. 1977 269 p refs
(Grants AF-AFOSR-2273-72; AF-AFOSR-3281-77)
(AD-A038813; ESL-R-723; AFOSR-77-0581TR) Avail: NTIS HC A12/MF A01 CSCL 12/2

This dissertation introduces concepts and associated computational procedures that are applicable to a mathematical problem arising in the context of Operations Research and Stochastic Control. Briefly stated, the problem is to design a strategy for real-time decision-making on the basis of imperfect (state) information and finite memory. The plant, i.e. the object to be controlled, is modelled as a finite probabilistic system (FPS) or stationary discrete-time, finite-input, finite-output, finite-state controlled stochastic process, a generalization of the partially-observed Markov decision model initiated by Drake (1962), which itself generalizes the Markov decision model of Bellman (1957a). GRA

N77-28903# Wisconsin Univ., Madison. Mathematics Research Center.
AN EFFICIENT COMPUTATIONAL PROCEDURE FOR SOLVING THE MULTI-FACILITY RECTILINEAR FACILITIES LOCATION PROBLEM
Henrik Juel and Robert Love Feb. 1977 12 p refs
(Contract DAAG29-75-C-0024)
(AD-A038953; MRC-TSR-1720) Avail: NTIS

HC A02/MF A01 CSCL 12/2

The multi-facility location problem with rectilinear distances is considered. A necessary and sufficient optimality condition is stated and proved. An algorithm is developed and computational results are given. A new lower bound for multifacility problems with I sub p distances is also given. Author (GRA)

N77-28904# Wisconsin Univ., Madison. Mathematics Research Center.

ON THE DUAL OF THE LINEARLY CONSTRAINED MULTI-FACILITY LOCATION PROBLEM WITH ARBITRARY NORMS

Henrik Juel and Robert Love Feb. 1977 9 p refs
(Contract DAAG29-75-C-0024)
(AD-A038954; MRC-TSR-1721) Avail: NTIS HC A02/MF A01 CSCL 12/2

In this article the dual of the multi-facility location problem with arbitrary norms is developed. The formulation allows any number of linear constraints in the primal. It is shown that the multipliers associated with the linear equations of the dual are the optimal facility locations of the primal. Author (GRA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N77-28905# Wisconsin Univ., Madison. Mathematics Research Center.

MONOTONE INVARIANT SOLUTIONS TO DIFFERENTIAL INCLUSIONS

Frank H. Clarke and J. P. Aubin Mar. 1977 22 p refs
(Contract DAAG29-75-C-0024)
(AD-A038962; MRC-TSR-1729) Avail: NTIS HC A02/MF A01 CSCL 12/1

Let a given set be endowed with a preference preordering, and consider the problem of finding a solution to a differential inclusion which remains in the given set and evolves monotonically with respect to the preordering. Sufficient conditions are given for the existence of such a trajectory, couched in terms of a notion of tangency developed by Clarke. No smoothness or convexity is involved in the construction, which uses techniques of Filippov. GRA

N77-28906# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.

THE DENSEST HEMISPHERE PROBLEM

D. S. Johnson and F. P. Preparata Jan. 1970 27 p refs
(Contract DAAB07-72-C-0259; Contract NSF-MC-76-17321)
(AD-A036361; R-757; UILU-ENG-77-2204) Avail: NTIS HC A03/MF A01 CSCL 12/1

Given a set of K of n points on the unit sphere S superscript d in d-dimensional Euclidean space, a hemisphere of S superscript d is densest if it contains a largest subset of K. This paper considers the problem of determining a densest hemisphere and present the following complementary results: (1) a discretized version of the original problem, restated as a feasibility question, is NP-complete when both n and d are arbitrary; (2) when the number d of dimensions is fixed, there exists a polynomial time algorithm which solves the problem with a number of operations O((n to the (d-1)th power)log n) on the random access machine with unit cost arithmetic operations. GRA

N77-28783*# Massachusetts Inst. of Tech., Cambridge.

A CONSTRUCTIVE APPROACH TO COMMUTATIVE RING THEORY

David A. Spear *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 369-376 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 12A

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N77-28907# Cincinnati Univ., Ohio. Dept. of Physics.

FLUX PINNING AND FLUX FLOW STUDIES IN SUPERCONDUCTORS USING FLUX FLOW NOISE TECHNIQUES Progress Report, 1 Apr. - 17 Dec. 1976

W. C. H. Joiner Dec. 1976 23 p refs
(Contract EY-76-S-02-2890)
(COO-2890-1) Avail: NTIS HC A02/MF A01

Measurements of flux flow noise power spectra have been combined with critical current measurements and measurements of current-voltage characteristics to study flux flow and local pinning interactions effective during flux flow. A model of flux flow noise generation in the presence of local pinning interactions is developed and applied to situations where pinning is dominated by: (1) grain boundaries, (2) normal metal precipitates in a superconducting matrix, (3) gross deformation producing a critical current peak effect; and (4) surface grooves imposed on a sample surface. In the case of pinning caused by normal metal precipitates in a superconducting matrix, unusual training and hysterisis effects are observed in the flux flow characteristics. ERA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N77-28908*# Princeton Univ., N. J.

ACOUSTOELASTICITY

E. H. Dowell Jul. 1977 99 p refs
(Grant NsG-1253)
(NASA-CR-145110) Avail: NTIS HC A05/MF A01 CSCL 20A

Sound or pressure variations inside bounded enclosures are investigated. Mathematical models are given for determining: (1) the interaction between the sound pressure field and the flexible wall of a Helmholtz resonator; (2) coupled fluid-structural motion of an acoustic cavity with a flexible and/or absorbing wall; (3) acoustic natural modes in multiple connected cavities; and (4) the forced response of a cavity with a flexible and/or absorbing wall. Numerical results are discussed. Author

N77-28909# Aeronautical Research Council, London (England).

THE REFRACTION OF SOUND BY A SHEAR LAYER MADE UP OF DISCRETE VORTICES

Ann P. Dowling (RAE, Farnborough, Engl.) 1975 25 p refs Supersedes RAE-TR-74001; ARC-35489
(ARC-R/M-3770; RAE-TR-74001; ARC-35489;
ISBN-0-11-470915-7) Avail: NTIS HC A02/MF A01; HMSO £2.90; PHI

Rays from a moving sound source are traced through a regular array of convected vortices (representing a turbulent jet) and also through the corresponding mean shear flow. The far-field intensity is compared in the two cases and significant differences are found. Author

N77-28910*# Mississippi Univ., University.

ATMOSPHERIC ABSORPTION OF HIGH FREQUENCY NOISE AND APPLICATION TO FRACTIONAL-OCTAVE BANDS Final Report

F. Douglas Shields and H. E. Bass Washington NASA Jun. 1977 239 p refs
(Contract NAS3-19431)
(NASA-CR-2760) Avail: NTIS HC A11/MF A01 CSCL 20A

Pure tone sound absorption coefficients were measured at 1/12 octave intervals from 4 to 100 KHz at 5.5K temperature intervals between 255.4 and 310.9 K and at 10 percent relative humidity increments between 0 percent and saturation in a large cylindrical tube (i.d., 25.4 cm; length, 4.8 m). Special solid-dielectric capacitance transducers, one to generate bursts of sound waves and one to terminate the sound path and detect

the tone bursts, were constructed to fit inside the tube. The absorption was measured by varying the transmitter receiver separation from 1 to 4 m and observing the decay of multiple reflections or change in amplitude of the first received burst. The resulting absorption was compared with that from a proposed procedure for computing sound absorption in still air. Absorption of bands of noise was numerically computed by using the pure tone results. The results depended on spectrum shape, on filter type, and nonlinearly on propagation distance. For some of the cases considered, comparison with the extrapolation of ARP-866A showed a difference as large as a factor of 2. However, for many cases, the absorption for a finite band was nearly equal to the pure tone absorption at the center frequency of the band. A recommended prediction procedure is described for 1/3 octave band absorption coefficients. Author

N77-28911*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INTERIOR NOISE REDUCTION IN A LARGE CIVIL HELICOPTER
James T. Howlett, Sherman A. Clevenson, John A. Rypf (Joint Inst. for Advan. of Flight Sci., Hampton, Va.), and William J. Snyder Jul. 1977 43 p refs
(NASA-TN-D-8477; L-11349) Avail: NTIS HC A03/MF A01 CSCL 20A

The results of an evaluation of the effectiveness of current noise reduction technology in attaining acceptable levels of interior noise in a large (about 20,000 kg) passenger-carrying helicopter are presented. The helicopter studied is a modified CH-53A with a specially designed, acoustically treated passenger cabin. The acoustic treatment reduced the average A-weighted interior noise levels from 115 db to 87 db. The study suggests selected improvements in the acoustic treatment which could result in additional reduction in cabin noise levels. The resulting levels would be only slightly greater than the interior noise levels of current narrow-body jet transports. Author

N77-28912*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC AND ACOUSTIC PERFORMANCE OF HIGH MACH NUMBER INLETS
Edward Lumsdaine, Lorenzo R. Clark, Jenn C. Cherng, and Ismail Tag Washington Aug. 1977 77 p refs Prepared in cooperation with Tenn. Univ., Knoxville
(NASA-TN-D-8444; L-11388) Avail: NTIS HC A05/MF A01 CSCL 20A

Experimental results were obtained for two types of high Mach number inlets, one with a translating centerbody and one with a fixed geometry (collapsing cowl) without centerbody. The aerodynamic and acoustic performance of these inlets was examined. The effects of several parameters such as area ratio and length-diameter ratio were investigated. The translating centerbody inlet was found to be superior to the collapsing cowl inlet both accoustically and aerodynamically, particularly for area ratios greater than 1.5. Comparison of length-diameter ratio and area ratio effects on performance near choked flow showed the latter parameter to be more significant. Also, greater high frequency noise attenuation was achieved by increasing Mach number from low to high subsonic values. Author

N77-28913# Naval Postgraduate School, Monterey, Calif.
A PRELIMINARY INVESTIGATION OF ACOUSTIC ENERGY TRANSMISSION FROM A TAPERED FLUID LAYER INTO A FAST BOTTOM M.S. Thesis
James Nathaniel Edwards, Jr. Dec. 1976 53 p refs
(AD-A038616; NPS-33JE76121) Avail: NTIS HC A04/MF A01 CSCL 20/1

The transmission of acoustic energy from a tapered fluid layer into an underlying layer of fluid was investigated. Pulsed transmissions at frequencies of 75.85 K Hz and 107.5 were used to insonify the upper layer while a small probe transducer was used to measure signal amplitude variation with depth in the lower layer. The experimental data collected indicate that a directional transmission of acoustical energy into the lower layer occurs over regions corresponsing to the individual cutoff depths for normal modes in the upper layer. A simple method for estimating the position of these regions is discussed and the effects of frequency and upper layer slope variations are reported. Author (GRA)

N77-28914# California Inst. of Tech., Pasadena. Guggenheim Jet Propulsion Center.
EXPERIMENTAL STUDIES OF THE NOISE PRODUCED IN A SUPERSONIC NOZZLE BY UPSTREAM ACOUSTIC AND THERMAL DISTURBANCES Final Report
Jerome M. Auerbach Washington DOT Jun. 1976 259 p refs
(Contract DOT-OST-20197)
(PB-264933/3; DOT-TST-76-105) Avail: NTIS HC A12/MF A01 CSCL 21E

A steady accelerating flow was produced in a rectangular supersonic nozzle with an entrance Mach number of 0.2 - and an exit Mach number of 1.38. A rotary valve bleed flow system and an electrical wire resistance heater upstream of the nozzle introduced mass flow and temperature fluctuations into the nozzle flow at frequencies up to 500 Hz. Sound measurements were made at six positions along the nozzle and outside the nozzle assembly, which was enclosed in an anechoic chamber. All data acquisition and processing was done with a computer-controlled data acquisition system. By synchronization of the bleed flow and heater, a pure temperature disturbance without an associated pressure disturbance caused by heating was produced. GRA

N77-28915# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
ANALYSIS OF COMBUSTION GENERATED NOISE Final Technical Report, May 1974 - Dec. 1976
H. A. Hassan Dec. 1976 52 p refs
(Contract DOT-OS-40056)
(PB-265005/9; NCSU-MAE-TR-76-1; DOT-TST-77-25) Avail: NTIS HC A04/MF A01 CSCL 21B

Various aspects of combustion generated noise are presented. These include: an extension of Lighthill's acoustic analogy to combustion generated noise and using the theory to derive expressions for the sound power output and characteristic frequency; a study of sound propagation in ducts in the presence of combustion; calculation of flow fields in combustors; and a procedure for calculating the spectrum of combustion generated noise. The predictions of the theories presented here are shown to be in good agreement with the experiment. GRA

N77-28916# Purdue Univ., Lafayette, Ind. Ray W. Herrick Labs.
UNIVERSITY NOISE RESEARCH: PROCEEDINGS OF THE EPA-UNIVERSITY NOISE SEMINAR Final Report
Joseph W. Sullivan and Andrew F. Seybert Dec. 1976 193 p refs Proc. held at Lafayette, Ind., 18-20 Oct. 1976
(Contract EPA-68-01-3555)
(PB-265114/9; EPA-550/9-77-300) Avail: NTIS HC A09/MF A01 CSCL 20A

Research, development and demonstration projects in all areas of noise control except noise generated by aircraft are discussed. Emphasis was placed on non-Federally funded programs and hardware oriented projects. An appendix to the report provides an extensive compendium of university noise research projects regardless of the nature of the source or sponsoring institution. GRA

N77-28917# Hughes Research Labs., Malibu, Calif.
THIN FILM OPTICAL SWITCH Final Report, 22 Oct. 1976 - 21 Jan. 1977
Bor U. Chen and Gregory L. Tangonan Feb. 1977 32 p refs
(Contract N00173-76-C-0113)
(AD-A036481) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report, together with three previous quarterly reports, presents the design, development, fabrication and evaluation of a wideband optical switch based on the deflection of two dimensionally confined beams by electro-optically controlled phase grating. The waveguide medium is Ti-diffused $LiNbO_3$. An interdigital electrode is placed on the overlapped region of two crossed channel waveguides. When a voltage is applied to the electrode, a Bragg phase grating is formed so that the optical beam in one channel waveguide is deflected into the opposite one. In order to interface the switching device to single mode

optical fibers, 4 micrometers wide single mode channel waveguides are employed at the input and output ports. These waveguides are expanded adiabatically through slowly tapered sections into wide multimode channel waveguides (30 micrometers) that intersect in the grating interaction region. GRA

N77-28918# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
CALCULATION OF DAY-NIGHT LEVELS (LDN) RESULTING FROM CIVIL AIRCRAFT OPERATIONS Final Report
D. E. Bishop, A. P. Hays, N. H. Reddingius, and H. Seidman Mar. 1976 374 p refs
(Contract EPA-68-01-3218)
(PB-266165/0; BBN-3157; EPA-550/9-77-450) Avail: NTIS HC A16/MF A01 CSCL 20A

A method is described for calculating the day/night noise level, at a point, due to aircraft operations from an airport. Factors considered include type of takeoff and landing procedure, range, and non-standard glide slopes. The procedure used is to locate the position of the point in question, relative to the runway and aircraft flight track. A series of charts give Ldn values for different types of aircraft in terms of the distance parameters. Adjustments are made to the single event noise levels to account for frequency of operations and the adjusted levels are added logarithmically to represent all of the classes of aircraft using the airport. GRA

N77-28919*# Texas Univ., Austin. Applied Research Labs.
SATURATION OF PLANE ACOUSTIC WAVES AND NOTES ON THE PROPAGATION OF FINITE AMPLITUDE SPHERICAL WAVES Interim Report
Don A. Webster Jan. 1977 106 p refs
(Contracts NAS1-14160; F44620-76-C-0040; Grant NOAA-04-5-022-12; AF Proj. 9781)
(NASA-CR-154111; AD-A035694; ARL-TR-77-4; AFOSR-77-0065TR) Avail: NTIS HC A06/MF A01 CSCL 20/1

This paper investigates saturation of plane acoustic waves in an air-filled tube. Saturation, a state in which the signal amplitude at a field point approaches a limiting value, independent of source amplitude--is caused by nonlinear propagation distortion. The author observed it in a 30-m long, 5-cm i.d. progressive wave tube. Measured saturation curves were obtained for the following source conditions; sound pressure levels from 110 to 163 db, frequencies from 500 Hz to 3500 Hz. The model equations of Merklinger and Rudnick were adapted and solved to give theoretical predictions for the fundamental component of the wave. The Merklinger model is found to give good results at low levels, and the Rudnick model at high levels. Measurements generally confirm theoretical predictions. The effect of dispersion due to the tube wall boundary layer was analyzed separately and found to be not great for the fundamental component. Its effect layer was analyzed separately and found to be not great for the fundamental component. Certain aspects of the propagation of spherically spreading waves of finite amplitude were also studied. A graphical method for assessing the importance of nonlinearity on spherical waves is discussed. New theoretical results for weak waves and for strong waves were found. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N77-28920 Texas A&M Univ., College Station.
ELECTRON-IMPACT IONIZATION OF ATOMIC OXYGEN Ph.D. Thesis
Thomas Michael Burnett 1976 101 p
Avail: Univ. Microfilms Order No. 77-2600

Electron-impact ionization cross sections for atomic oxygen are calculated in the Born approximation. The initial bound state of atomic oxygen is represented by a configuration interaction wavefunction. Configurations used in the expansion were determined by calculating certain bound-bound oscillator strengths and comparing with recent experimental data. The final continuum state of atomic oxygen is represented by a close-coupling wavefunction. As a final test of the wavefunctions photoionization, cross sections are calculated in the dipole length and velocity approximations and compared with other experimental and theoretical works. In the case of electron-impact ionization, triple, double, and single differential and total cross sections are calculated as well as generalized oscillator strengths. An interesting feature in the triple differential cross sections is the appearance of a dip in the binary peak. A comparison of total cross sections is made with available experimental and theoretical works. The comparisons are favorable. Finally, sources of error are indicated along with suggestions for improvement. Dissert. Abstr.

N77-28921 Texas A&M Univ., College Station.
K-SHELL VACANCY CREATION BY LIGHT IONS IN THE INTERMEDIATE AND HIGH ENERGY REGIONS Ph.D. Thesis
Edward Ellis Fitchard 1976 86 p
Avail: Univ. Microfilms Order No. 77-2618

Approximation methods are developed for calculating the K-shell vacancy creation cross-sections for incident projectiles in the intermediate and the high energy regions. For the high energy region, the Cheshire approximation is used and compared with the first Born and Glauber approximations. The results for the three approximation methods are presented at a range of energies for carbon, copper and titanium. For the intermediate energy region, the Born approximation is used to include terms of second order in the interaction potential. The results for a range of energies are given for titanium, aluminum and nickel. The cross-sections obtained agree well with experiments at the lowest energies considered. A reason for the discrepancy at higher energies is suggested. Dissert. Abstr.

N77-28922 Texas Univ., Austin.
MULTIELECTRON TRANSITIONS FOLLOWING HEAVY ION EXCITATION: A COMPARISON OF SELF-CONSISTENT FIELD CALCULATIONS WITH EXPERIMENT Ph.D. Thesis
William Lyle Hodge, Jr. 1976 90 p
Avail: Univ. Microfilms Order No. 77-3918

Experimental spectra of X-ray transitions induced by heavy ion bombardment are presented. The experimental energies are compared to Hartree-Fock transition energies. The transitions observed lower in energy than the K alpha line are two electron - one photon radiative Auger and three electron - one photon radiative electron rearrangement transitions. Experimental data taken at other laboratories have measured satellite lines higher in energy than the K beta satellite structure. Relativistic Dirac-Fock transition energies are compared to the experimental energies and the transitions are shown to be two electron - one photon X-ray transitions. Theoretical transition energies from five different self-consistent field atomic physics computer programs are compared to the K alpha satellite and K alpha hypersatellite transitions of Calcium. Transition energies from Desclaux's relativistic Dirac-Fock program are compared to the diagram lines of Uranium and to other theoretical K X-ray transition energies of Z = 120. Dissert. Abstr.

N77-28923 Indiana Univ., Bloomington.
THE LOW ENERGY PHOTOIONIZATION OF THE HYDROGEN MOLECULE Ph.D. Thesis
John Richmond Rumble, Jr. 1976 272 p
Avail: Univ. Microfilms Order No. 77-1994

A theoretical study of the low-energy photoionization of the hydrogen molecule is presented. The basis of this study is the numerical solution of the appropriate two-dimensional Schroedinger equation, whose approach should better reflect the two-center nature of the problem. The system of sparse linear equations generated was solved by a highly optimized Crout algorithm. Extensive testing of various parameters and mesh sizes was done. Exchange was accounted for by an iterative procedure. Vibrational effects were described within the Born-Oppenheimer approximation. Dissert. Abstr.

N77-28924*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SCALING OF CROSS SECTIONS FOR K-ELECTRON CAPTURE BY HIGH-ENERGY PROTONS AND ALPHA-PARTICLES FROM THE MULTIELECTRON ATOMS
K. Omidvar Jun. 1976 27 p refs Submitted for publication

(NASA-TM-71355; X-620-77-151) Avail: NTIS HC A03/MF A01 CSCL 20H

Electron capture by protons from H, He, and the K-shell of Ar, and alpha particles from He are considered. It is shown that when a certain function of the experimental cross sections is plotted versus the inverse of the collision energy, at high energies the function falls on a straight line. At lower energies the function concaves up or down, depending on the charge of the projectile, the effective charge and the ionization potential of the electron that is being captured. The plot can be used to predict cross sections where experimental data are not available, and as a guide in future experiments. High energy scaling formulas for K-electron capture by low-charge projectiles are given. Author

N77-28925# Phrasor Technology, Pasadena, Calif.
MECHANISMS OF EMITTER SURFACE DAMAGE DURING EHD COLLOID PARTICLE GENERATION AND ACCELERATION Interim Report, 1 Feb. 1976 - 31 Jan. 1977
Julius Perel and John F. Mahoney Mar. 1977 15 p
(Contract F44620-75-C-0056)
(AD-A038982; AFOSR-77-0540TR) Avail: NTIS HC A02/MF A01 CSCL 21/8

A model of emitter tip erosion has been developed that correlates with performance degradation. The erosion is caused by back bombardment of the emitter by negative ions produced from the break up of slow droplets as a result of collisions with fast ions. Calculations are made assuming the droplets are all the same size rather than using the distribution of droplet sizes actually observed. If at least one negative ion is produced at each ion/droplet collision the resulting sputtering date is sufficient to explain the measured erosion. GRA

N77-28926# California Inst. of Tech., Pasadena. Kellogg Radiation Lab.
BEAM-FOIL SPECTROSCOPY Final Report, 1 Jan. 1971 - 31 Dec. 1976
Ward Whaling 21 Feb. 1977 32 p refs
(Contract N00014-75-C-042421)
(AD-A036195) Avail: NTIS HC A03/MF A01 CSCL 07/4

This report describes measurements of atomic transition probabilities in Fe III, Nd II, Ti I, and Mn I carried out in 1976, and refers briefly to measurements in Fe II, Ni I, Cr I, Pr I carried out since 1971. Method is beam-foil time-of-flight measurements of radiative lifetime of a level, combined with a measurements of the branching ratio for the decay of the level. Purpose and evolution of the research program over the past six years is discussed. GRA

N77-28927# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
SPIN-ORBITAL ELECTRONEGATIVITY, THE X-ALPHA METHOD, AND REACTIVITY AT TRANSITION-METAL INTERFACES Interim Report
K. H. Johnson 28 Feb. 1977 43 p refs
(Contract N00014-75-C-0970)
(AD-A036584; TR-5) Avail: NTIS HC A03/MF A01 CSCL 07/4

It is shown that the concept of electronegativity, originally viewed as a virtually constant characteristic of an atom, can be generalized to the individual molecular orbitals of aggregates of atoms, utilizing the self-consistent-field X-alpha density-functional representation of molecular-orbital theory in conjuction with the definition of orbital electronegativity proposed by Hinze et al. This generalization allows for the dependence of electronegativity on the detailed electronic structure of a group of atoms as a function of its composition, geometry, and local chemical environment. In transition metals and transition-metal coordination complexes, where local magnetic spin polarization of electrons is important, the concept of orbital electronegativity can be further generalized to the individual spin-orbitals. By viewing a transition-metal surface, cluster, or coordination complex as providing orbital or spin-orbital pathways for electrons to effectively flow between reactants, where such flow directly between reactants in the gas phase is forbidden by orbital-symmetry restrictions or unfavorable electronegativity differences, orbital or spin-orbital electronegativity can be used in conjunction with X-alpha calculations for representative clusters and complexes as an approximate index of heterogeneous or homogeneous reactivity. Recent applications of this concept to a number of problems associated with reactivity at transition-metal interfaces are reviewed, including: the dissociation and reactivity of hydrogen at low-coordination transition-metal sites; the interaction of atomic hydrogen with transition-metal interfaces; and the surface reactivity of iron. Author (GRA)

N77-28928# Oak Ridge National Lab., Tenn. Health Physics Div.
INVERSE MEAN FREE PATH, STOPPING POWER, CSDA RANGE, AND STRAGGLING IN Ge AND GaAs FOR ELECTRONS OF ENERGY 10 keV Interim Report, Jul. - Sep. 1976
J. C. Ashley, C. J. Tung, R. H. Ritchie, and V. E. Anderson Nov. 1976 34 p refs Sponsored by DNA and ERDA
(AD-A035511; RADC-TR-76-350) Avail: NTIS HC A03/MF A01 CSCL 20/12

The interaction of electrons with the solids Ge and GaAs is described, based on a model insulator theory for the valence band electrons and inner shell ionization derived from classical-binary-collision cross sections. Contributions to the inverse mean free path and stopping power from the various interaction processes are tabulated for electron energies from threshold, approximately 2 eV for Ge and approximately 2.5 eV for GaAs, to 10 keV. Electron range in the continuous slowing-down approximation and straggling are tabulated for electron energies from 10 eV to 10 keV for both materials. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N77-28929 Notre Dame Univ., Ind.
A NONRELATIVISTIC FLUID THEORETIC APPROACH TO THE FOUR-BODY PROBLEM Ph.D. Thesis
Antonio Carlos DeSaFonseca 1977 157 p
Avail: Univ. Microfilms Order No. 77-2132

The field theoretic method of Amado is extended to the four-body sector through the formulation of a model that describes a nonrelativistic four-body scattering process. The model is related to Bronzan's extended Lee model but the allowed interactions are restricted so that the resulting dynamical equations are as simple as possible, yet still exact. Three possible applications and generalizations of the model are successively discussed: the spinless version of the four nucleon system, spin and isospin effects in the four nucleon system, and a four body model of two particle transfer reactions to assess the importance of higher orders of the correlations between the two exchanged particles to the transfer cross section. Dissert. Abstr.

N77-28930 City Univ. of New York.
THEORETICAL STUDIES IN MEDIUM AND HIGH ENERGY HADRON-NUCLEUS AND NUCLEUS-NUCLEUS COLLISIONS Ph.D. Thesis
Girish Kumar Varma 1976 118 p
Avail: Univ. Microfilms Order No. 77-3708

The high energy diffraction theory due to Glauber is the basis for studies of a variety of nuclear collisions. The approximations leading to the theory of particle-nucleus scattering are discussed, and its extension to nucleus - nucleus collisions is compared with an exact nucleus-nucleus multiple scattering series. An exact solution is obtained for the charged hadron-deuteron scattering problem with both the incident hadron and the bound proton having extended charge distributions. Coulomb effects in scattering of charged hadrons from other nuclei are studied. Several frequently used approximate models are considered and their accuracy assessed. The problem of deuteron scattering from complex nuclei is addressed. The effects on elastic scattering intensities due to Coulomb field and the quadrupole deformation of the deuteron are investigated. The general case of nucleus-nucleus collisions is explored. Dissert. Abstr.

N77-28931# Air Force Weapons Lab., Kirtland AFB, N.Mex.
VACUUM PROPAGATION OF AN INTENSE RELATIVISTIC ELECTRON BEAM Final Report
Robert B. Miller and David C. Straw Mar. 1977 46 p refs (AF Proj. 2301)
(AD-A038056; AFWL-TR-76-156) Avail: NTIS HC A03/MF A01 CSCL 20/8

In this report the results of a series of electron beam vacuum propagation experiments are presented and compared with theoretical predictions. Important conclusions pertaining to time-dependent diode behavior, virtual cathode formation, and various equilibrium and stability criteria are reported.
Author (GRA)

74 OPTICS

Includes light phenomena.

N77-28932* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
METHOD AND APPARATUS FOR PRODUCING AN IMAGE FROM A TRANSPARENT OBJECT Patent
Sing H. Lee and Arnold R. Shulman, inventors (to NASA) (Calif. Univ., La Jolla) Issued 12 Jul. 1977 7 p Filed 30 Dec. 1975 Supersedes N76-16395 (14 - 07, p 0847)
(NASA-Case-GSC-11989-1; US-Patent-4,035,062; US-Patent-Appl-SN-645500; US-Patent-Class-350-162SF; US-Patent-Class-350-202; US-Patent-Class-350-299) Avail: US Patent Office CSCL 20F

The contrast produced from a photographic transparency is controlled by placing the transparency between a pair of partially reflecting mirrors forming walls of an optical cavity. Mirrors trap a collimated laser beam illuminating the transparency so that at least a portion of the beam energy is passed through the transparency plural times. The distance that the light beam travels between the mirrors is controlled as a function of the wavelength of the beam energy to control the phase of light interference in the beam passing through the transparency, thereby controlling the intensity of the beam derived from the mirror downstream of the transparency. Official Gazette of the U.S. Patent Office

N77-28933* National Aeronautics and Space Administration. Pasadena Office, Calif.
LIGHTWEIGHT REFLECTOR ASSEMBLY Patent
Maurice J. Argoud (JPL), Jack Jolley (JPL), and Walter L. Walker, inventors (to NASA) (JPL) Issued 12 Jul. 1977 9 p Filed 24 Sep. 1975 Supersedes N75-32894 (13 - 23, p 2979) Sponsored by NASA
(NASA-Case-NPO-13707-1; US-Patent-4,035,065; US-Patent-Appl-SN-617202; US-Patent-Class-350-310; US-Patent-Class-350-288; US-Patent-Class-350-320) Avail: US Patent Office CSCL 20F

An inexpensive, lightweight reflective assembly member having good optical quality and particularly adaptable to accommodating temperature variations without providing destructive thermal stresses and reflective slope errors is described. The reflective assembly consists of a thin sheet of glass with appropriate reflective coating and a cellular glass block substrate bonded together. The method of fabrication includes abrading the cellular substrate with an abrasive master die to form an appropriate concave surface. An adhesive is applied to the abraded surface and a lamina reflective surface is placed under a uniform pressure to conform the reflective surface onto the desired abraded surface of the substrate.
Official Gazette of the U.S. Patent Office

N77-28934 Kansas Univ., Lawrence.
DETERMINATION OF THE OPTICAL BIDIRECTIONAL REFLECTANCE FROM SHADOWING PARAMETERS Ph.D. Thesis
Dwight David Egbert 1976 295 p
Avail: Univ. Microfilms Order No. 77-2209

Laboratory and field experiments were conducted to analyze angular bidirectional reflectance variations from types of earth cover surfaces commonly surveyed in earth resources remote sensing applications. Two models were developed, each containing five major components: forescatter specular reflectance, backscatter specular reflectance, diffuse reflectance from perturbation, diffuse reflectance from plane background, and a shadow function to modulate reflectance components. The theoretical shadow models derived for ideal perturbation shapes accurately predict reflectance variations for natural surfaces with irregularly shaped perturbations. This demonstrates that total shadow area, and the rate of change of this area with angle, are independent of the exact shape of surface perturbations. Thus, an operational reflectance correction model is feasible which will not require detailed information about surface geometry as input. Dissert. Abstr.

N77-28935# Grumman Aerospace Corp., Bethpage, N.Y. System Sciences Section.
IMAGE ROTATION IN OPTICAL CORRELATORS THROUGH ROTATIONAL DEVICES
Ronald Herold and Kenneth Leib Jan. 1977 27 p refs
(RM-627) Avail: NTIS HC A03/MF A01

Parallel faced, image rotation prisms were analyzed to determine their offset and other beam phase change effects under perfect, and less than perfect, constructions. Results show that offset by a perfect prism generally does not affect optical correlator performance but wedges greater than 0.2 arc second seriously affect correlator performance. Author

N77-28936# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
DETECTION ASPECTS OF AN OPTICAL MATCHED FILTER IMAGE CORRELATOR M.S. Thesis
Glenn M. Mehalek Mar. 1977 41 p refs
(RM-628) Avail: NTIS HC A03/MF A01

A set of matched filters was made for an M-60 Army tank is described. A set of three filters varying in optimized spatial frequency was then selected. Correlation signal to noise ratios were obtained, and normalizations of the correlation plane signals to total scene intensity and total correlation plane intensity were performed. A simple thresholding technique as suggested. A point-by-point normalization technique was proposed with the intent of improving the signal to noise ratio for the system, and a simple application of this technique was implemented. Author

N77-28937*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THREE-MIRROR TELESCOPE Patent Application
Dietrich Korsch, inventor (to NASA) (Sperry Rand Corp., Huntsville, Ala.) Filed 29 Jun. 1977 13 p Sponsored by NASA
(NASA-Case-MFS-23675-1; US-Patent-Appl-SN-820498) Avail: NTIS HC A02/MF A01 CSCL 20F

A telescope is described which employs an ellipsoidal primary mirror which receives light from a scene being viewed and reflects it in a hyperbolic secondary mirror. The light is then reflected through a central opening in the primary mirror to a tertiary mirror, which is reflected as a viewable image in a conveniently located finite plane for viewing. NASA

N77-28938# Sandia Labs., Albuquerque, N. Mex.
SUMMARY OF RADIATION-INDUCED TRANSIENT ABSORPTION AND RECOVERY IN FIBER OPTIC WAVEGUIDES
Clifford D. Skoog Nov. 1976 127 p
(Contract E(29-1)-789)
(SAND-76-8056) Avail: NTIS HC A07/MF A01

The absorption induced in fiber optic waveguides by pulsed electron and X-ray radiation was measured as a function of optical wavelength from 450 to 950 nm, irradiation temperature from -54 to 71 C, and dose from 1 to 500 krads. The fibers studied are Ge-doped silica core fibers, pure vitreous silica core fibers, polymethyl-methacrylate core fibers, and polystyrene core fibers. Models that were developed to account for the observed absorption recovery are also summarized. ERA

N77-28939# Hospital of the Univ. of Pennsylvania, Philadelphia. Dept. of Dermatology.
ACOUSTICALLY SCANNED OPTICAL IMAGING DEVICES Semiannual Report, 1 Jul. - 31 Dec. 1976
Gordon S. Kino Jan. 1977 63 p
(Contract N00014-76-C-0129; ARPA Order 2778)

(AD-A038342; GL-2675; SAR-3) Avail: NTIS HC A04/MF A01 CSCL 20/1

Results obtained with the airgap convolver system are described. It is shown that the system is very suitable for use in a storage correlator; the basic problems are associated with bulk wave feedthrough and other spurious responses. Considerable progress has been made in this respect. The experimental results we have obtained, and a detailed theory of the device which we have developed, tend to indicate a possible dynamic range for the device of 60 db, well comparable to the convolver. The device is ideally suitable as a variable delay device, which can be externally programmed to delay signals several hundred microseconds long by times of a few microseconds. GRA

N77-28940# Battelle Columbus Labs., Ohio.
OPTICAL PATTERN RECOGNITION OF DISTANT TARGETS: A NEW SYSTEM OF OPTICAL SCALING AND MODELING
John R. Shewell 19 Jan. 1977 47 p
(Contract DAHC04-72-A-0001)
(AD-A038325; RE-CR-77-3) Avail: NTIS HC A03/MF A01 CSCL 17/8

This report presents the basic principles of a new system of optical scaling and modeling. These principles apply to any optical situation in which the illumination is totally coherent and for which the paraxial approximation is valid. The primary scaling relation is a geometrical similarity between the output diffraction patterns of an original optical system and its model. The optical scaling based on these principles is called ordinary scaling.
Author (GRA)

N77-28941# Frankford Arsenal, Philadelphia, Pa.
HIGH SPEED FABRICATION OF PRECISION OPTICS Final Engineering Report
Martin H. Horchler Oct. 1976 36 p refs
(AD-A038064; FA-TR-76063) Avail: NTIS HC A03/MF A01 CSCL 13/9

This study was an effort to reduce the time required to manufacture high quality military fire control lenses by utilizing high speed production techniques currently being used to produce medium quality optics. The effort was successful, and the results as well as the procedures for making the tools and using the techniques are summarized in this report. GRA

N77-28942# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
INVESTIGATION OF IMAGE PROCESSING FOR FLIR Final Report
May 1976 68 p
(Contract DAAG53-75-C-0245)
(AD-A038111; C75-671.6/501) Avail: NTIS HC A04/MF A01 CSCL 17/5

The aim of this effort has been to evaluate previously developed locally developed contrast normalization and other image enhancement techniques to FLIR image processing. The local contrast enhancement technique has demonstrated the ability to match high dynamic range image data to a limited dynamic range display. Additional image enhancement techniques investigated include contouring, one- and two-dimensional frequency filtering, and interframe averaging. GRA

N77-28943# Syracuse Univ., N. Y. Dept. of Physics.
INFRARED DETECTOR RESEARCH Final Report, Apr. 1972 - Sep. 1975
Henry Levinstein, Timothy Braggins, Kevin Riley, and Moshe Lanir Wright-Patterson AFB, Ohio AFAL Aug. 1976 304 p refs
(Contract F33615-73-C-1066)
(AD-A038677; AFAL-TR-76-83) Avail: NTIS HC A14/MF A01 CSCL 17/5

Work on infrared detectors was started at Syracuse University in February 1948. The research has represented a continuing effort in the development and analysis of new infrared detector materials, the construction of detectors from these materials as well as measurement and analysis of the parameters of these detectors. The two most important accomplishments of the work at Syracuse University have been the development of the first liquid nitrogen cooled detector in the 3-6 micrometers range to be used in the U.S. aircraft (PbTe), and the first detector in the 8-14 micrometers range which did not require liquid helium but could be operated with mechanical coolers (Ge:Hg). In addition, a great deal of progress has been made in developing test techniques, in preparing and understanding the behavior of impurities in InSb and in Ge. Most recently, p and n type impurities in silicon have been studied. Currently both HgCdTe and PbSnTe are being prepared in our laboratory and an effort is being made to prepare better and more reproducible material and to understand the behavior of both materials. GRA

N77-28944# Wisconsin Univ., Madison.
AN ALL-REFLECTION FOURIER TRANSFORM INTERFEROMETER FOR THE 500- TO 1000-MICROMETER WAVELENGTH REGION Final Report
F. L. Roesler, D. Tracy, D. Huppler, R. Fonck, and Mark Daehler 6 Apr. 1977 25 p refs
(Contract N00014-67-A-0128-0025)
(AD-A038829; NRL-8094) Avail: NTIS HC A02/MF A01 CSCL 20/6

An all-reflection, two-beam interferometer has been designed, constructed, and tested. It may fill the need for a rugged, cryogenically coolable instrument for space applications. The interferometer uses a grating with symmetric grooves as a beam splitter. Each of the two arms contains a blazed grating with identical groove spacing to nullify the dispersion caused by the beam splitter. A model operated essentially as anticipated. An effect due to the asymmetric displacement of the side gratings with respect to the beam splitter has been explained both theoretically and experimentally. Author (GRA)

N77-28945# Stanford Research Inst., Menlo Park, Calif.
EVALUATION OF TECHNOLOGIES FOR INFRARED IMAGING Final Technical Report, 5 Feb. - 15 Nov. 1975
Kamala S. Krishnan and John S. Ostrem Wright-Patterson AFB, Ohio AFAL Nov. 1976 143 p refs
(Contract F33615-75-C-1142; SRI Proj. ISE-4047)
(AD-A036211; AFAL-TR-76-82) Avail: NTIS HC A07/MF A01 CSCL 17/5

This report assesses the practical value of a new technique of upconverting infrared radiation using two-photon pumped alkali metal vapors and compares the relative merits of several approaches to IR imaging. Performance criteria of passive and active IR imaging systems are chosen and practical configurations are defined. The principles of IR upconversion using alkali metal vapors and the infrared quantum counter are detailed. The upconversion efficiency, acceptance angle and IR bandwidth are evaluated. Upconversion with nonlinear crystals and direct detection of IR are also briefly treated. Detailed and practical systems are designed for passive and active imaging based on the several approaches and the performance indicators are evaluated. The upconversion methods in their present stage of development are not found to perform as well as the state-of-the-art direct-detection methods. The infrared quantum counter (IRQC) is at present the best upconversion candidate for thermal imaging because of its ability to integrate the thermal radiation. Upconversion in sodium vapor is promising in both the passive and active cases approaching, in the latter, the performance of direct detection. The IRQC does not appear to have any merit for active imaging. The performance of nonlinear crystal upconverters is significantly poorer than the metal-vapor upconverters.
Author (GRA)

N77-28946# National Bureau of Standards, Washington, D. C. Optical Physics Div.
OPTICAL RADIATION MEASUREMENTS: THE 1973 NBS SCALE OF SPECTRAL IRRADIANCE Final Report
R. D. Saunders and J. B. Shumaker Apr. 1977 40 p
(PB-266040/5; NBS-TN-594-13) Avail: NTIS HC A03/MF A01 CSCL 14B

The measurement apparatus and techniques used in deriving the 1973 scale of spectral irradiance are described. The uncertainty of this scale is believed to be less than 2% in the spectral region 250 nm-500 nm and less than 1% in the spectral region 500 nm-1,600 nm. This uncertainty represents a threefold improvement over the previous NBS scale of spectral irradiance. The complete derivation of the projected solid angle, which is crucial when transferring from radiance to irradiance, is given. A model for interpolating the spectral irradiance at wavelengths

between the wavelengths measured is given. Measurement details are presented, and sources of error are discussed. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N77-28947# Wisconsin Univ., Madison.
DIFFUSION AND FLUCTUATION MEASUREMENTS IN THE TRAPPED ELECTRON AND TRAPPED ION REGIMES
J. R. Drake, D. W. Kerst, G. A. Navratil, R. S. Post, S. Ejima (General Atomic Co., San Diego, Calif.), C. Moeller LaHaye (General Atomic Co., San Diego, Calif.), T. Ohkawa (General Atomic Co., San Diego, Calif.), P. I. Petersen (General Atomic Co., San Diego Calif.), R. Prater (General Atomic Co., San Diego, Calif.), and S. K. Wong 1976 13 p refs
(Contract E(11-1)-2387)
(COO-2387-76; IAEA-CN-35/D-11) Avail: NTIS HC A02/MF A01

Experiments were performed in the Wisconsin Levitated Octupole with a weak toroidal magnetic field added to the octupole field. When the ions were collisionless or collisional, the diffusion scaling observed in the absolute minimum-B regions indicated convective diffusion driven by mirror-trapped electrons. When the ions were collisionless, both a dissipative trapped ion mode and a collisionless trapped ion mode were observed in the average minimum-B region. These modes were distinguished by their propagation direction in the plasma frame and were not present without the weak toroidal field or when the ions were made collisional. When these modes were present, the plasma transport was increased by an order of magnitude. Experiments were performed in the General Atomic dc Octupole in the regimes in which dissipative trapped electron and trapped ion modes are expected to occur. Dissipative trapped electron modes were observed and studied in detail. ERA

N77-28948# Florida Univ., Gainesville. Dept. of Engineering Sciences.
TWO-PHASE HARTMANN FLOWS IN THE MHD GENERATOR CONFIGURATION Annual Report, Dec. 1975 - Dec. 1976
E. R. Lindgren, U. H. Kurzweg, R. E. Elkins, and T. A. Trovillion Jan. 1977 35 p refs
(Contract N00014-76-C-0410; NR Proj. 099-412)
(AD-A036452) Avail: NTIS HC A03/MF A01 CSCL 20/9

Two-phase Hartmann flows in an MHD generator duct of rectangular cross-section are examined and numerical values for the velocity fields and induced current streamlines for fluids of spatially-dependent electrical conductivity are determined as a function of load factor, Hartmann number and channel aspect ratio. This study is of considerable practical interest in connection with some experimental work on two phase liquid metal-gas MHD generators and the results presented herein may enhance the understanding of the operating characteristics of such devices. Results indicate that conductivity gradients can produce inflected velocity profiles which may be hydrodynamically unstable, that for larger load factors the shunt current in the Hartmann boundary layers become considerable and that two-phase MHD flows of moderate void fractions have sound speeds considerably lower than in its components. Turbulent effects are not considered in these studies since turbulent fluctuations are expected to be suppressed for the high Hartmann number flows of interest in two-phase MHD generators. GRA

N77-28949# Naval Research Lab., Washington, D. C. Plasma Physics Div.
INTENSE RELATIVISTIC ELECTRON BEAM INTERACTION WITH A COOL THETA PINCH PLASMA
D. A. Hammer, K. A. Gerber, W. F. Dove (ERDA, Washington, D.C.), G. C. Goldenbaum (Maryland Univ., College Park), B. G. Logan (Lawrence Livermore Lab., Calif.), K. Papadopoulos, and A. W. Ali Jan. 1977 116 p refs
(NRL Proj. H02-288)
(AD-A036308; NRL-MR-3439) Avail: NTIS HC A06/MF A01 CSCL 20/9

Experimental results are presented for the heating of a 4 m long plasma confined by a uniform magnetic field of 4-5 kG by an intense relativistic electron beam. The initial plasma density ranged from approximately 5 x 10 to the 13th power cu cm to approximately 3 x 10 to the 15th power cu cm, the lower density cases being partially ionized and the higher density cases highly ionized. In all cases, the energy coupled from the beam to the plasma is greater than can be explained by binary collisions between beam electrons and the plasma particles. Over most of the density range tested, 5 x 10 to the 13th power cu cm to 1.5 x 10 to the 15th power cu cm the plasma heating cannot be explained by classical processes. These results are found to be explained quantitatively by the use of a full nonlinear treatment of the electron-electron two stream instability in the kinetic regime. A review of beam plasma interaction theory and previous experiments is presented to facilitate comparison with the present results. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N77-28950 Indiana Univ., Bloomington.
MODELS OF PHASE TRANSITIONS IN SUPERIONIC CONDUCTORS Ph.D. Thesis
Kumble Ramarao SubbaSwamy 1976 108 p
Avail: Univ. Microfilms Order No. 77-1997

The effect of the transfer term in the lattice gas Hamiltonian in the statistical mechanical treatment of phase transitions in some superionic conductors (or ionic solids with high ionic conductivity) was examined. The periodic cell cluster method was applied to the triangular lattice, choosing a 3-cell cluster of 4-site cells which maintain the sublattice structure of the lattice. No evidence of a sharp phase transition for any value of the applied field was found, in contrast to mean field theory. This explains the non-existence of a sharp transition in the super-lattice of beta-alumina observed experimentally. The renormalization method was used to obtain the impurity contribution to the free energy of a square Ising lattice with a single impurity. A comparison of the cumulant expansion result with the exact result, shows that the second order cumulant leads to irregular behavior. Dissert. Abstr.

N77-28951 California Univ., Los Angeles.
TRANSPORT OF MOBILE IONS IN METAL-SILICON DIOXIDE-SILICON STRUCTURES Ph.D. Thesis
Ronald Jere Roedel 1976 285 p
Avail: Univ. Microfilms Order No. 77-1658

The kinetics of mobile ions in metal-silicon dioxide-silicon (MOS) structures were investigated under the assumption that the ionic motion is excitation or emission limited. It is postulated that at each of the interfaces in an MOS capacitor there exists a deep and capacious potential well that can trap (and thus immobilize) the ions. Two models for the nature of the interfacial wells are examined. The formulation adopted is applied to an analysis of the transient motion of ions from one interface to another at constant (but elevated) temperature and applied field by monitoring the isothermal trasient ion current. The thermally stimulated ionic current temperature response of a MOS sample subjected to a constant applied field and a temperature that varies linearly in time from room temperature to 600 K was investigated. The current voltage response for a MOS device subjected to a constant elevated tamperature and a linear ramp bias is measured. Dissert. Abstr.

N77-28952 Rensselaer Polytechnic Inst., Troy, N. Y.
ELECTRONIC PROPERTIES OF AMORPHOUS NICKEL PHOSPHORUS ALLOYS Ph.D. Thesis
Paul John Cote 1976 130 p
Avail: Univ. Microfilms Order No. 77-2824

It is shown that liquid metal theory provides the basis for explaining electron transport in metallic glasses. Electrodeposited glassy nickel phosphorus is a convenient system for demonstrating

this because it is a binary alloy which is amorphous over a wide composition range. The resistivities of five amorphous NiP samples were measured between 4.2 and 293K and show an increase from 100 to 180 mu omega cm as the phosphorus content increases from 15 to 25.4 at.%. The presence of ferromagnetic clusters is indicated by an excess specific heat and by susceptibility measurements. These are believed to originate form composition inhomogeneities in electrodeposited NiP. Resistivity data on a variety of other metallic glasses are reviewed and also found to be compatible with the model provided here for amorphous NiP. It is therefore concluded in this thesis that liquid transition metal theory provides the basic framework for describing electron transport in metallic glasses. Dissert. Abstr.

N77-28953 Texas Univ., Austin.
MOLECULAR MOTION IN SOLID ETHANE: A PROTON MAGNETIC RESONANCE STUDY Ph.D. Thesis
Fenton Lynwood Givens 1976 174 p
Avail: Univ. Microfilms Order No. 77-3904

Nuclear magnetic resonance techniques were applied to solid ethane in the temperature range of 4K to 90K. The derivative of the nuclear magnetic resonance absorption curve was experimentally measured; the linewidth and the second moment have been calculated. The existence of two solid phases has been confirmed. The high temperature solid phase is characterized by rapid diffusion. As the temperature is decreased, the second moment increases between the solid-solid transition temperature and 72K. This has been interpreted as end-for-end flipping of the molecule with an energy barrier of 1.6 kcal/mole. Between 40k and 30K, tunneling of the molecule about the carbon-carbon axis competes with thermally activated reorientation to produce a small step-like increase in the second moment. Dissert. Abstr.

N77-28954 Tennessee Univ., Knoxville.
SPECTRAL DENSITY FUNCTIONS FOR DISORDERED SYSTEMS Ph.D. Thesis
Dennis Gene Hall 1976 94 p
Avail: Univ. Microfilms Order No. 77-3642

Numerical calculation to interpret the qualitative features of recent neutron scattering data on amorphous systems is presented. In the absence of a reliable theory of elementary excitations in structurally disordered systems, model calculations become extremely important in pointing out the properties to be expected of such systems. The spectral density is a particularly important quantity in this regard since it gives the single-particle contribution to the dynamic form factor of neutron scattering theory. Dissert. Abstr.

N77-28955 Ohio Univ., Athens.
THE GREEN FUNCTION THEORY OF THE FERROELECTRIC PHASE TRANSITION IN KDP Ph.D. Thesis
Venkatraman Ramakrishnan Ramakrishnan 1976 77 p
Avail: Univ. Microfilms Order No. 77-3494

Fermion Green functions were used to investigate both the static and dynamical properties of the ferroelectric transition in KH2PO4. Two forms of decoupling were used. In the first approximation a Tyablikov type decoupling was performed, and the problem was solved in both the pure pseudospin and, with some approximations, in the coupled pseudospin case. Later, a symmetric type decoupling was considered, and dynamical results were obtained for both the pure pseudospin and the coupled cases. The Tyablikov decoupling reproduces all the results of the Weiss approximation. In the symmetric decoupling approximation, the dynamical results are similar to those of the equation of motion method. In addition, equations for the static properties of KDP have been obtained, which can be solved if necessary. The method also reproduces results for the transverse susceptibility. Dissert. Abstr.

N77-28956 Rensselaer Polytechnic Inst., Troy, N. Y.
A DENSITY OF STATES CALCULATION IN DISORDERED ALLOYS BY A GENERALIZED COHERENT-POTENTIAL APPROXIMATION Ph.D. Thesis
Thomas Parnell McManus 1976 163 p
Avail: Univ. Microfilms Order No. 77-2831

The coherent-potential approximation (CPA) of Soven was proved to be a very effective tool in solving the problem of a disordered binary alloy for the electronic density of states. It is generally considered to be the best known single site approximation. The CPA is generalized to allow both consideration of clusters of sites and of random off-diagonal elements of the Hamiltonian. Calculations were made for simple one dimensional disordered binary alloy in the tight binding model. The results of these calculations are presented and analyzed. Results are compared with exact computer model calculations and they reproduce the central features of the density of states spectra quite well. It is concluded that the generalization of the CPA is a viable one, deserving further study. Dissert. Abstr.

N77-28957 Washington Univ., St. Louis, Mo.
LOW FREQUENCY NONRESONANT ACOUSTIC MAGNETIC INTERACTIONS IN MgO:Fe2+ Ph.D. Thesis
Marjorie Passini Yuhas 1976 282 p
Avail: Univ. Microfilms Order No. 77-4063

The coupling of acoustic waves nonresonantly to the spin system of a paramagnetic ion is demonstrated. Because of its better than average acoustic properties and its large magnetoelastic coupling constants (G11, G44), MgO: Fe(2+) is an easily studied prototype of a strongly coupled spin-phonon system. The data on MgO:Fe(2+) are used to verify the theoretical expressions for acoustic absorption and dispersion due to low frequency nonresonant spin-phonon interactions. In addition, data are used to obtain information concerning the coupling of the electron spin systems to the lattice, that is spin-lattice relaxation mechanisms. Dissert. Abstr.

N77-28958 Illinois Univ., Urbana-Champaign.
TEMPERATURE DEPEDENT STUDIES ON STRUCTURAL AND ELECTRONIC EFFECTS IN SINGLE CRYSTALS Ph.D. Thesis
Gerald Lee Delker 1976 192 p
Avail: Univ. Microfilms Order No. 77-8974

The first system is the octahedral complex tris(4-((6-methyl-2-pyridyl)-3-aza-3-butenyl)-amino iron hexafluorophosphate, which exhibits a sharp change in magnetic moment from high-spin to low-spin near 215 K in the solid state. The second system is the one-dimensional semi-conductor tetrathiofulvalinium bis-cis-(1, 2-perfluoromethylethylene-1, 2-dithiolato) copper, which exhibits a small, but sharp break in the magnetic susceptibility near 250 K due to a first order phase transition, and undergoes a spin-Peierls transition to a singlet ground state at 12.4 K. The third molecule is the first stable silacyclopropane compound, dimethyldispiro (bicycle (4.1.0)-heptane-7,2'-silacyclo-propane-3'7-bicyclo(4.1.0)heptane). The molecular structure was determined using single crystal X-ray diffraction, and is compared with that reported for other three-membered ring compounds. The final molecule is 9,9-dipyrazolyl-9-borabicyclo-(3,3,1)-nonane dicarbonyl trihaptoallyl molybdenum. This complex has a proton which has a chemical shift of 15 tau which is greater than previously observed for a nonbonded metal-hydrogen interaction. Dissert. Abstr.

N77-28959 California Univ., San Diego.
CRITICAL PHENOMENA IN A BINARY LATTICE GAS Ph.D. Thesis
John Anthony Barton Gualtieri 1976 210 p
Avail: Univ. Microfilms Order No. 77-8722

The critical behavior of a two-component lattice gas model that exhibits a line of critical points is studied using mean field theory and exact series expansion techniques. The mean field theory exhibits the qualitative features of the model's phase diagram in which a line of critical points bounding a two-phase coexistence region is shown to extend from a finite temperature to zero-temperature. Cluster counting algorithms for a simple cubic lattice are presented that give exact series expansions for the thermodynamic potential and hence all thermodynamic functions. By using the model's inherent symmetry between the two types of particles that make up the pair of components, the task of computing the exact series expansions is made more tractable. The expansions have been computed in terms of three suitable variables--activities of the particles and a temperature-like variable--for both low densities and high densities of the particles. Dissert. Abstr.

N77-28960# Cornell Univ., Ithaca, N.Y.
FAR INFRARED PROPERTIES OF LATTICE RESONANT MODES 6 HYDROSTATIC PRESSURE EFFECTS
A. M. Kahan, M. Patterson, and A. J. Sievers Jun. 1976 48 p refs
(Contract E(11-1)-3151)
(COO-3151-69) Avail: NTIS HC A03/MF A01

The frequency shifts produced by hydrostatic pressure were measured for four resonant mode systems NaC: Cu(+), KBr: Li(+), KI: Ag(+) and CsI: Tl(+). The experimental results were successfully characterized with an anharmonic oscillator model. Shifts were also measured for the tunnelling and excited state modes of KCl: Li(+). The tunnelling mode (1.15/cm for (Li6)(+) at zero strain) increases to 30/cm at 1.1 percent strain. An extra low frequency transition provides direct evidence that the tunnelling levels in the lowest manifold are not equally spaced. It is found that the double harmonic oscillator model which has been used previously to describe the tunnelling levels does not adequately describe the pressure dependence of the five observed absorption lines in KCl: Li(+). Analysis of the data indicates that the off-center Li(+) ion goes on-center with application of a 0.5 percent strain. At 0.65 percent strain the KCl: Li(+) spectrum is vitually identical to the KBr: Li(+) spectrum at zero strain.
ERA

N77-28961# Harvard Univ., Cambridge, Mass. Dept. of Chemistry.
CRYSTAL AND MOLECULAR STRUCTURE Final Report, 1 Apr. 1968 - 31 Jan. 1977
William N. Lipscomb Mar. 1977 31 p refs
(Contract N00014-76-C-0199; NR Proj. 053-178)
(AD-A038090) Avail: NTIS HC A03/MF A01 CSCL 07/2

The history of the early chemical and structural studies of boranes is referred to briefly with emphasis on the geometrical differences between compounds of carbon, and the more compact compounds of boron. The second part discusses the nature of three-center bonds, and their use in explaining the bonding in some of the more open types of boron compounds. In the third part molecular orbitals are described, with special reference to their transferability among geometrically related systems. The use of molecular orbital methods for prediction is exemplified. Finally the value of all of these methods is tested for predictions of chemical reactivity and molecular transformations with emphasis on boranes and carboranes. GRA

N77-28962# Rome Air Development Center, Griffiss AFB, N.Y.
GALLIUM ARSENIDE DEVELOPMENT FOR HIGH POWER MICROWAVE SOURCES
Joseph M. Milan Feb. 1977 44 p
(AD-A038052; RADC-TR-76-407) Avail: NTIS HC A03/MF A01 CSCL 20/12

Liquid phase epitaxy (LPE) of gallium arsenide conducted at RADC beginning in FY 74 is summarized. A detailed description of the growth procedures using a graphite slider boat is presented. The results of various growth schedules using the graphite slider are given with the conclusion that growth above 800 C is too highly compensated (yields material with too many impurities).
Author (GRA)

N77-28963# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
ELECTRONIC PROPERTIES OF SOLIDS Final Report, 1 Jul. 1964 - 30 Jun. 1974
D. W. Langer Jan. 1977 28 p refs
(AD-A038440; AFAL-TR-76-155) Avail: NTIS HC A03/MF A01 CSCL 20/12

Solid state devices have been widely used in the electronics area for many years and more recently are being used extensively in the electro-optic field. The properties of these devices depend strongly on the material properties, of the semiconductor from which they are produced. The investigations in this work unit were concentrated on several wide band gap materials composed of elements from group II and group VI of the periodic table. The approach centered around studying the basic properties of the pure material and also the effect of doping impurities. The investigations from this work unit have had an impact in the scientific community by providing a large number of material constants which clarify the electronic and electro-optic behavior of these materials. They have also uncovered new phenomena, new research approaches and material parameters useful in testing specialized aspects of the theory of solids. Author (GRA)

N77-28964# Aerospace Corp., El Segundo, Calif. Ivan A. Letting Labs.
METAL-INSULATOR-SEMICONDUCTOR STUDIES OF LEAD TELLURIDE
David A. Lilly, David E. Joslin, and Alan H. K. Kan 7 Apr. 1977 23 p refs
(Contract F04701-76-C-0077)
(AD-A038996; TR-0077(2270-20)-1; SAMSO-TR-77-72) Avail: NTIS HC A02/MF A01 CSCL 20/12

The capacitance and conductance-voltage characteristics were measured on metal-insulator-semiconductor capacitors fabricated with zirconium dioxide films on single-crystal lead telluride. At 77 K, on both n- and p-type substrates, evidence of surface potential control was obtained. Comparison of the measured capacitance-voltage characteristics with those calculated from the equilibrium solution of the one-dimensional Poisson equation indicates qualitative agreement, although the slope (dC/dV) of the measured capacitance in the region near the capacitance minimum is less steep than calculated. The high-frequency response of the capacitance and position of the capacitance minimum were used to deduce the presence of an inversion layer on some n-type substrates of charge density approximately 5.0 times 10 to the 13th power per sq cm. This layer was found to be dependent on surface preparation treatment prior to insulator deposition. Results of surface chemical studies indicate that inversion may be due to oxide formation during chemical etching. Conductance data obtained confirm the existence of a large interfacial state density. GRA

N77-28965# Picatinny Arsenal, Dover, N. J.
SHOCK WAVE INDUCED STRUCTURAL PHASE TRANSFORMATIONS
Paul Harris Dec. 1976 60 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A038252; PA-TR-5026) Avail: NTIS HC A04/MF A01 CSCL 21/2

Shock induced structural phase transformations, for two military motivated problems, are considered. Structural transformations in metallic alloys (e.g. TiNi) are examined from both macroscopic and microscopic (soft phonon mode) viewpoints. Both viewpoints are found to be consistent with the possibility of growth (avalanching) of the amplitude of a transformation inducing propagating shock wave. The relationship between such avalanching and the design considerations for an optically activated detonator is treated. The thermomechanics of the alpha to epsilon transition in iron (130 kilobars) is examined for the case where that transition is induced by a shock in the presence of an external magnetic field. Magnetostriction effects are included in the analysis. It is concluded that solid state physics relevant to the alpha to epsilon transition could be important to materials selection for armor. Author (GRA)

N77-28966# California Inst. of Tech., Pasadena. Div. of Chemistry and Chemical Engineering.
A SIMPLE SINGLE-COIL DOUBLE RESONANCE NMR PROBE FOR SOLID STATE STUDIES Interim Report
M. E. Stoll, A. J. Vega, and R. W. Vaughan Feb. 1977 20 p refs Submitted for publication
(Contract N00014-75-C-0960; NR Proj. 056-065)
(AD-A036282; TR-5) Avail: NTIS HC A02/MF A01 CSCL 20/8

A single coil (Solenoid), nuclear magnetic double resonance sample probe, suited for a wide variety of solid state studies, is described. It was designed to be used in double resonance experiments where it is necessary to generate intense rf magnetic fields (rotating components with amplitudes about 50 gauss) at two widely spaced frequencies and to simultaneously detect microvolt-level signals. Designs for operation over the 12-270 MHz frequency range are discussed. Author (GRA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N77-28967*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ANALYSIS AND RADIANT HEATING TESTS OF A HEAT-PIPE-COOLED LEADING EDGE

Charles J. Camarda Washington Aug. 1977 43 p refs

(NASA-TN-D-8468; L-11247) Avail: NTIS HC A03/MF A01 CSCL 20M

The performance of a heat pipe cooled leading edge was investigated experimentally and analytically. The test model and radiant heaters were positioned to simulate aerodynamic heating distributions and gravity effects at angles of attack of 0 deg, 10 deg, and 20 deg. Steady-state stagnation heating ranged from 239 kW/sq m to 395 kW/sq m with heat pipes operating at temperatures of 883 K and 922 K, respectively. A simple analytical technique was used to determine startup, transient, and steady state performance of the heat pipes during testing. Experimental results agreed well with calculated results for the thermal behavior of the leading edge. Results verified successful operation of the leading edge for all tests, including the design condition which simulated the reentry heating environment of a Phase B shuttle orbiter. Author

N77-28968# Oak Ridge Y-12 Plant, Tenn. Lab. Development Dept.

THERMAL CONDUCTIVITY OF HALITE USING A PULSED LASER

D. D. Smith 13 Dec. 1976 40 p refs

(Contract W-7405-eng-26)

(Y-DA-7013) Avail: NTIS HC A03/MF A01

Thermal conductivities of salts (NaCl) and a steel casing material using a pulsed laser technique are presented. Optically transparent materials such as salt were effectively coated with an opaque layer of aluminum or silver to satisfy test boundary conditions. Thermal conductivities for the three specimens were obtained from the thermal diffusivity, heat capacity and density relationship. Based on measurements from room temperature to 923 K, single crystal halite yielded values ranging from 6.5 to 1.5 W/m-K versus 5.5 to 1.2 W/m-K for Avery Island Bed Salt. AISI 106-Grade B steel gave values of 46 to 29 W/m-K. Attributes of this technique include the generation of data very quickly which is more applicable to testing large numbers of specimens relative to steady-state methods. The use of penny-sized specimens can be a problem from the fabrication requirement, especially for friable and anisotropic geological materials. The quality of the data rests on the adherence of the experimental design to the mathematical model. ERA

N77-28969# California Univ., Berkeley. Dept. of Mechanical Engineering.

ON THERMODYNAMICS AND THE NATURE OF THE SECOND LAW. 1: SINGLE PHASE CONTINUA, SUPPLEMENT

A. E. Green and P. M. Naghdi Dec. 1976 35 p refs

(Contract N00014-75-C-0148; NR Proj. 064-436)

(AD-A036271; UCB-AM-76-7-Suppl) Avail: NTIS HC A03/MF A01 CSCL 20/13

The present supplement contains some additional development concerning the mathematical statement of the second law and restrictions on the heat conduction vector and internal energy, as well as two examples which demonstrate some shortcomings of the Clausius- Duhem inequality. One of the examples, when studied with the use of the Clausius-Duhem inequality, leads to results that imply the possibility of a perpetual motion of the second kind. In the second example, which is concerned with a rigid heat conductor in thermal equilibrium, the Clausius-Duhem inequality requires that if heat is added to the medium the resulting spatially homogeneous temperature of the conductor decreases. Moreover, the inequality denies the possibility of propagation of heat in the conductor as a thermal wave with finite speed. The inequalities proposed here do not suffer from these shortcomings. GRA

N77-28970# Idaho Univ., Moscow. Center for Applied Thermodynamic Studies.

GUIDE FOR THE USE OF COMPUTER PROGRAMS FOR LEAST SQUARES FITTING OF EQUATIONS OF STATE TO THERMODYNAMIC DATA. VOLUME 2: PROGRAMS FOR SIMULTANEOUS FITTING OF MULTIPLE DATA FORMS USING STEPWISE REGRESSION

R. T. Jacobsen, R. B. Stewart, and T. Christian Apr. 1976 181 p refs

(Grant NSF ENG-75-03275)

(PB-266615/4; CATS-76/4-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 07D

Computer programs developed at the Center for Applied Thermodynamic Studies at the University of Idaho for incorporating several data forms in a multiple stepwise regression in the determination of a thermodynamic equation of state are described. Methods are included for incorporating P-rho-T data, isochoric heat capacity data, saturation density data (to define liquid-vapor phase equilibrium criteria), velocity of sound data, and second virial coefficients in the determination of an equation of state. The weighted least squares fit uses polynomial functions of up to 50 terms with large sets of measured data. Provisions are included for the selective elimination of individual terms on the basis of a statistical analysis of the fit. These programs were prepared specifically for the development of a thermodynamic formulation for oxygen and must be modified for use with other fluids. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N77-28971 Alabama Univ., Huntsville.

A RISK MINIMIZATION APPROACH TO MULTIPLE CRITERIA DECISION ANALYSIS Ph.D. Thesis

Pat Reynolds Odom 1976 135 p

Avail: Univ. Microfilms Order No. 77-2713

Applications of a risk minimization approach to analysis of management decision problems involving multiple goals and constraints with uncertainties in problem input-data, are investigated. The analysis concept, termed multirisk programming, is based on determination of the alternative decision solutions which minimize probabilities that the decision maker's goals and constraints will not be satisfied. The baseline type of problem considered is that of selecting the best subset of m decision entities from a candidate set of n entities, such that specified multiple goals and constraints are satistied with minimum risk. The multirisk programming method, model, and computer implementation are presented. A series of case studies performed using the computer model is summarized to illustrate the broad range of potential applications of the analysis concept.

Dissert. Abstr.

N77-28972# Committee on Science and Technology (U. S. House).

NASA PROGRAM PLANNING AND CONTROL, PART 2

Washington GPO 1976 21 p Hearing before Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 94th Congr., 2d Sess., no. 84, 1 Jul. 1976

(GPO-76-106) Avail: Subcomm. on Space Sci. and

Applications CSCL 05A

Data bases compiled by NASA for ten field centers are analyzed by GAO representatives and inconsistencies found are discussed. Data base information included: (1) research and development program descriptions and manpower data; (2) facilities data; and (3) a description of management planning and control techniques. Problems with the implementations of NASA's planning guidelines are identified, and recommendations for improvement are made. A.R.H.

N77-28973# Joint Economic Committee (U. S. Congress).
PRIORITIES AND EFFICIENCY IN FEDERAL RESEARCH AND DEVELOPMENT
Washington GPO 1976 119 p refs Papers submitted to Subcomm. on Priorities and Economy in Govt. of the Joint Economic Comm., 94th Congr., 2d Sess., 29 Oct. 1976 Prepared by the Library of Congr., Congresional Res. Service
(GPO-70-801) Avail: SOD HC $1.40 CSCL 05A

Procedures followed by the executive and legislative branches of the government in the determination of research and development priorities, policies, programs, and project levels were assessed by independent experts to determine how decisions are made, the relative priorities of different types of activities, the results of federally supported programs, and their effects on the economy. Topics discussed include: (1) the relationship between defense-related and civilian-oriented R and D priorities; (2) Senate procedures for authorizing military R and D; (3) the effectiveness of federal civilian-oriented R and D programs; (4) the relationship between federal, state, and local governemnt support for R and D; and (5) federal support of R and D activities in the private sector. A.R.H.

N77-28974# Texas Univ., Austin. Center for Cybernetic Studies.
MEASURING THE EFFICIENCY OF DECISION MAKING UNITS WITH SOME NEW PRODUCTION FUNCTIONS AND ESTIMATION METHODS.
A. Charnes, W. W. Cooper, and E. Rhodes 8 Oct. 1976 54 p refs
(Contract N00014-75-C-0616)
(AD-A038211; CCS-276) Avail: NTIS HC A04/MF A01 CSCL 12/1

A new series of linear programming models is used to clarify and extend a measure of efficiency introduced by M.J. Farrell. Multiple output as well as single output versions are provided which relate this efficiency to ordinary Pareto-Koopmans optimality conditions. Their duals supply numerical estimates of production coefficients. This duality, from mathematical programming, is distinguished from another in the theory of production and then used to provide new nonlinear duals which open contacts with other mathematical programming developments in areas like fractional programming, etc. GRA

N77-28975# Intermetrics, Inc., Cambridge, Mass.
LANGUAGE REQUIREMENTS REPORT Interim Report, Oct. 1975 - Apr. 1976
Benjamin M. Brosgol and James L. Felty Jul. 1976 112 p refs
(Contract DAHC26-76-C-0006; DA Proj. SX7-62725-D-Y10)
(AD-A038214; IR-179-2; USACSC-AT-76-06) Avail: NTIS HC A06/MF A01 CSCL 09/2

The main purpose of this report is to identify the programming language requirements for the implementation of Army tactical data systems. In addition, language facilities needed for business-oriented management information systems are derived, and are compared with the requirements for tactical systems. The methods employed to identify the needed features include a review of Army responses to questionnaires concerning language requirements; interviews with Army personnel knowledgeable in various tactical systems; and examination of system specifications documents and secondary material. The fundamental result of this study is that, despite some special requirements for programming tactical and MIS systems, there is no inconsistency between the basic language facilities needed for general purpose vs. tactical or MIS programming. In particular, the features described in the DoD High Order Language Working Group's Tinman document are consistent with the needs of tactical and MIS functions, especially with respect to the language goals of reliability and maintainability. Author (GRA)

N77-28976# Logistics Management Inst., Washington, D. C.
OSCR SYSTEM APPLICATIONS ANALYSIS
Joseph S. Domin and Craig A. Webster Dec. 1976 95 p ref Sponsored by DOD
(AD-A038477; LMI-76-15) Avail: NTIS HC A05/MF A01 CSCL 14/1

The Operating and Support Cost Reporting System, a management information system developed by the U.S. Air Force, is analyzed to determine how well the cost information needs of specific decisions and analytical processes are satisfied by output from the OSCR system. The capabilities and limitations of the present OSCR system are identified and a plan for implementing a series of recommended improvements is presented. Author (GRA)

N77-28977# California Univ., Berkeley.
FINANCIAL MANAGEMENT: BUDGETING AND REPORTING UNDER FEDERAL CONTRACTS AND GRANTS. ONE OF A SERIES OF ANALYSES AND REPORTS ON THE IMPACT OF FEDERAL REQUIREMENTS ON RESEARCH MANAGEMENT Final Report
Phyllis Trudeau and Norman H. Gross Jun. 1976 119 p refs (Grant NSF NM-39538)
(PB-265166/9) Avail: NTIS HC A06/MF A01 CSCL 05A

Financial management, encompasses primarily budgeting, rebudgeting, reporting, and record-keeping, with special emphasis on their interrelationship. Main attention is focused on the proposal budget, the award budget, adherence and control aspects of the budget, rebudgeting philosophies, systems and controls, and expenditure reporting as it relates to various budgetary aspects. Grants are emphasized, and contracts are discussed only to illustrate specific problems. GRA

N77-28978# California Univ., San Diego. Research Management Improvement Project.
THE ORGANIZATION, MANAGEMENT AND SUPPORT SERVICES FOR A LARGE ORGANIZED RESEARCH UNIT WITHIN A UNIVERSITY: SCRIPPS INSTITUTION OF OCEANOGRAPHY. ONE OF A SERIES OF RESEARCH STUDIES UNDER THE RESEARCH MANAGEMENT IMPROVEMENT PROGRAM Final Report
Arthur B. Jebens and H. D. Johnson, ed. Sep. 1976 43 p (Grant NSF NM-39538)
(PB-264973/9) Avail: NTIS HC A03/MF A01 CSCL 05A

The organization management and administrative and technical support services for Scripps Institution of Oceanography within the environment of the University of California, San Diego campus and System-wide Administration were examined. The initial findings and recommendations of the reconnaissance survey are summarized. Emphasis is placed on the more limited administrative and management factors that may provide insights for other institutions grappling with related management issues. Management problems studied include: (1) planning and direction of the large-scale research programs; (2) management and coordination of large-scale research projects; (3) academic and student affairs; (4) indirect cost recovery issues; and (5) restructuring of the administrative and technical services. GRA

N77-28979# California Univ., Los Angeles. School of Engineering and Applied Science.
PROJECT MANAGEMENT THROUGH SIMULATION
A. M. Feiler Dec. 1976 44 p refs
(Contract N00014-76-C-0112)
(AD-A036335; UCLA-ENGR-76-119) Avail: NTIS HC A03/MF A01 CSCL 05/1

The role of critical path network analysis in project management is discussed. Specific shortcomings of conventional, deterministic network analysis techniques are outlined and examples are given of the individual factors which contribute to the overall optimism of deterministic analysis. Computer simulation is offered as means of developing realistic schedules, budgets and resource requirements for projects where uncertainty and performance variability are of significance. Author (GRA)

N77-28980# Defense Systems Management School, Fort Belvoir, Va.
RETURNING RDT AND E ASSETS (AIRCRAFT) TO OPERATIONAL USAGE Student Project Report
David M. Sjuggerud Nov. 1976 36 p refs
(AD-A036484) Avail: NTIS HC A03/MF A01 CSCL 05/1

The purpose of this study report is to review past aircraft programs to gain insight as to what aircraft utilization and program management techniques can be considered in the recovery and continued service utilization of RDT and E aircraft after reconfiguration. GRA

N77-28981# California Univ., Berkeley. Research Management Improvement Project.
THE IMPACT OF FEDERAL REGULATIONS ON RESEARCH MANAGEMENT IN COLLEGES AND UNIVERSITIES: OVERVIEW AND SUMMARIES Final Report
John A. Perkins, Herman D. Johnson (Calif. Univ., San Diego), and Robert F. Kerley Jul. 1976 64 p ref
(Grant NSF NM-39538)
(PB-265169/3) Avail: NTIS HC A04/MF A01 CSCL 05A

Basic principles regarding the relations between universities performing federally supported research and other projects and federal sponsoring agencies are considered. Cash flow, environmental health and safety, and federal procurement requirements are discussed along with financial management: budgeting and reporting under federal contracts and grants, indirect and direct cost recovery under federal contracts, and grants, and property management. Proposal preparation, negotiation and award, protection of human subjects, and time and effort reporting are included. GRA

N77-28982# National Bureau of Standards, Washington, D. C. System and Software Div.
THE CODASYL DATA BASE APPROACH: A COBOL EXAMPLE OF DESIGN AND USE OF A PERSONNEL FILE Final Report
Edgar H. Sibley Feb. 1974 81 p
(PB-265694/0; NBSIR-74-500) Avail: NTIS HC A05/MF A01 CSCL 05A

Examples of the use of the proposed CODASYL Data Definition Language and Data Base Language extensions to COBOL are given. The needs and data base elements which can be expected for a set of simple personnel applications are discussed. A few of the processes (programs) which are required by typical personnel departments, and their implementation (in outline) in three COBOL programs are described. GRA

N77-28983# Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.
A MODEL FOR ANALYSIS AND DESIGN OF UNIVERSITY RESEARCH SUPPORT SERVICES SYSTEMS Final Report, 1 Jul. 1975 - 31 Dec. 1976
S. R. Vemuri, R. N. Zapata, and A. R. Kuhlthau Mar. 1977 161 p refs
(Grant NSF NM-44250)
(PB-265137/0; UVA/526066/ESS77/102) Avail: NTIS HC A08/MF A01 CSCL 05A

A typical research support service system (RSSS), a simulation model was developed to analyze the effect on the productivity of research effort caused by procedural requirements on the system, and to examine ways in which technical support services can be provided effectively. RSSS effectiveness is defined in terms of three basic measures: principal investigator (pi) productivity; service timeliness; and cost. A simulation model of the University of Va. RSSS is constructed. The mechanics of the simulation are explained and instructions are provided to enable it to be adpated to the particular needs of any user.GRA

N77-28984# Pennsylvania State Univ., University Park.
THE ACADEMIC ADMINISTRATION OF RESEARCH: A DESCRIPTIVE ANALYSIS Final Report, 1 Jul. 1973 - 31 Jun. 1975
William E. Toombs, Renee Friedman, and Henry W. Sams 20 Mar. 1975 302 p refs
(Grant NSF NM-39530)
(PB-265149/5) Avail: NTIS HC A14/MF A01 CSCL 05A

Evaluation within universities of research in its proposals, project, and publication stages, of the agencies by which judgments are made, of relationships among these agencies, of criteria which pertain, and of the effective sanctions was studied. Focus is primarily on practices at the Pennsylvania State University, but some comparisons with other universities and with extra-academic research agencies are included. Range is over all fields of professional research, including the humanistic and social as well as scientific. Emphasis is on institutional address to administrative problems, but with due regard to all participating members of the research community. GRA

N77-28985# National Oceanic and Atmospheric Administration, Washington, D. C. Office of Coastal Zone Management.
STATE COASTAL ZONE MANAGEMENT ACTIVITIES, Annual Report, 1975 - 30 Jun. 1976
Dec. 1976 156 p
(PB-266012/4; NOAA-77030402) Avail: NTIS HC A08/MF A01 CSCL 13B

The activities of the U.S. coastal states and territories undertaken during their second year of coastal management program planning are described. The extent is shown of the financial commitment by the Federal Office of Coastal Zone Management and 33 of the 34 coastal states and territories that are participating. The federal and state matching funds are presented by yearly grant, with the cut-off point being the end of June 1976. GRA

N77-28986# National Science Foundation, Washington, D. C. Industry Task Force.
RESEARCH IN INDUSTRY: ROLES OF THE GOVERNMENT AND NATIONAL SCIENCE FOUNDATION
Dec. 1976 173 p refs
(PB-265904/3) Avail: NTIS HC A08/MF A01 CSCL 05A

A review of the role of scientific research in non-academic institutions is reported with particular attention to NSF programs and policies related to private industry. The report presents a brief review of how that policy has evolved over the years with several areas noted where new Federal initiatives might be appropriate. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N77-28987*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MULTIPURPOSE INTERACTIVE NASA INFORMATION SYSTEMS (MINIS)
Jun. 1977 45 p
(NASA-TM-78124) Avail: NTIS HC A03/MF A01 CSCL 05B

The Multipurpose Interactive NASA Information System was developed to provide remote, interactive information retrieval capability for various types of data bases to be processed on different types of small and medium size computers. Use of the system for three different data bases is decribed: (1) LANDSAT photo look-up, (2) land use, and (3) census/socioeconomic. Each of the data base elements is shown together with other detailed information that a user would require to contact the system remotely, to transmit inquiries on commands, and to receive the results of the queries or commands. Author

N77-28988# Zentralstelle fuer Luftfahrtdokumentation und Information, Munich (West Germany).
CONFERENCE PAPERS: AERONAUTICS, ASTRONAUTICS, SPACE RESEARCH, NO. 1
1977 203 p refs
(Rept-0001-0789; ISSN-0341-0269) Avail: NTIS HC A10/MF A01

Approximately 675 citations of relevant papers from conferences all over the world on aeronautics, astronautics, space research, and related subjects are presented in this bibliography.

Subject classification is based on NASA categories and INIS rules are followed in the bibliographic descriptions. Conference author, report number, subject, and corporate indexes are provided. A.R.H.

N77-28989# Xerox Corp., Palo Alto, Calif. Research Center.
PROPOSAL FOR RESEARCH ON INTERLISP AND NETWORK-BASED SYSTEMS Final Report, 1 Apr. 1975 - 31 Oct. 1976
W. Teitelman 26 Oct. 1976 12 p
(Contract N00014-75-C-0626; ARPA Order 2906; NR Proj. 049-372)
(AD-A033633) Avail: NTIS HC A02/MF A01 CSCL 09/2

The contract covered by this annual report includes a variety of activities and services centering around the continued growth and well-being of INTERLISP, a large, interactive system widely used in the ARPA community for developing advanced and sophisticated computer-based systems. GRA

N77-28990# Minnesota Univ., Minneapolis. Management Information Systems Research Center.
AN AUTOMATED ANNOTATED BIBLIOGRAPHY ON THE SPECIFICATION OF INFORMATION SYSTEM REQUIREMENTS Final Report, 1 Aug. - 11 Oct. 1976
Gordon C. Everest, Olin Bray, and Indulis Valters 11 Oct. 1976 59 p
(Contract N00167-76-M-8441)
(AD-A038400; MISRC-TR-77-01) Avail: NTIS HC A04/MF A01 CSCL 09/2

An automated, annotated bibliography containing 43 items is reported. All relate to the area of capturing and expressing as a language, a specification of information system requirements. Each item assigned descriptors and annotated from the perspective of database technology and database management systems. The report contains a description of the data items in the bibliographic schema and output consisting of (1) the bibliographic entries with descriptors and annotations, (2) Author index, (3) Descriptor index, (4) Thesaurus of descriptors. Author (GRA)

N77-28991# Forecasting International Ltd., Arlington, Va.
AN APPLICATION OF MARKET RESEARCH TECHNIQUES TO THE DISSEMINATION OF SCIENTIFIC AND TECHNICAL INFORMATION Interim Report
Ethelyn Bishop and Norman Wisenoff Feb. 1977 182 p
(Grant NSF DS-175-13211-A01)
(PB-265130/5) Avail: NTIS HC A09/MF A01 CSCL 05B

A methodology which will improve user access to STI by enabling producers and distributors of STI to better target their product design, distribution and promotion efforts is described. An analysis of the data gathered through a pilot survey of 402 electrical engineers and chemists identified six 'segments' in each discipline whose members have similar STI needs and other common characteristics including demographics, sources used to satisfy STI needs, and perceptions of current STI sources. GRA

N77-28992# Auerbach Corp., Philadelphia, Pa.
DECISION ANALYSIS TECHNIQUE FOR PROGRAM EVALUATION (GOAL PROGRAMMING) Final Report, 1 Jun. 1976 - 29 Apr. 1977
Thomas J. McGeehan 21 Apr. 1977 149 p refs
(Contract DSA900-75-C-5161)
(AD-A038800; AUER-2325/2326-TR-4) Avail: NTIS HC A07/MF A01 CSCL 05/2

A mathematical decision model for information service planning was derived from administrative goals. Program plans are assessed in the context of performance goals for six areas: available staff, available budget, program effectiveness, functional requirements, basic service requirements, investment programs to insure future progress. The technique is an extension of linear programming that calculates optimal solutions to decision problems in the areas of resource allocation, policy analysis and program evaluation according to a set of preemptive priorities established by management. The report includes a program in FORTRAN 4 for computing solutions. Author (GRA)

N77-28993# Dartmouth Coll., Hanover, N.H. Dept. of Mathematics.
NATURAL LANGUAGE DATA BASE QUERY: USING THE DATA BASE ITSELF AS THE DEFINITION OF WORLD KNOWLEDGE AND AS AN EXTENSION OF THE DICTIONARY Technical Report, Jan. 1976 - Feb. 1977
Larry R. Harris Feb. 1977 25 p refs
(Contract N00014-75-C-0514)
(AD-A036491; TR77-2) Avail: NTIS HC A02/MF A01 CSCL 05/7

This paper raises two issues that heretofore have not been dealt with in any previous natural language data base query system. These issues arise because of the everpresent need for world knowledge in the understanding of English, and also because of the particular way in which information is stored in a data base. The solutions to these problems described in this paper require only existing state of the art data base technology. Author (GRA)

N77-28994# Naval Underwater Systems Center, Newport, R. I.
SUBJECT INDEXING: DDC AND THE DOD TECHNICAL LIBRARIES Ph.D. Thesis - Simmons College
Ronald G. Heroux Feb. 1977 15 p
(AD-A039707) Avail: NTIS HC A02/MF A01 CSCL 05/2

The subject indexing produced by the Defense Documentation Center and a randomly selected number of DoD technical libraries is examined to determine: (1) Whether DDC or the DoD technical libraries assign more subject indexing terms per document; and (2) What percentage of subject indexing terms assigned by the DoD technical libraries are identical or similar to those used by DDC. The author makes the following conclusions: (1) DDC assigns more subject headings per document than almost all DoD libraries; (2) A little over 50% of the terms assigned by the DoD libraries are used by DDC analysts to catalog the same documents; (3) DDC and the DoD libraries are practically using the same vocabulary with which to index documents. GRA

N77-28995# Benson and Benson, Inc., Princeton, N. J.
STUDY OF NATIONWIDE ON-LINE ACCESS TO EVALUATED ENGINEERING DESIGN DATA. SURVEY 1: FOCUS GROUP STUDY Interim Report
Dec. 1976 55 p Prepared in cooperation with Engineering Index, Inc., New York
(Contract NSF DSI-76-16654)
(PB-264981/2) Avail: NTIS HC A04/MF A01 CSCL 05B

Bench engineers from various commercial, government and academic institutions located in Philadelphia, Los Angeles, and Chicago were questioned to determine how information is obtained in their work, the problems they have in obtaining information, their awareness of data centers as an information source, their likelihood of using on-line data retrieval, and their projected reasons for use or non-use. The survey was conducted to determine which, if any, new information products and services, including on-line interactive access, based on the Center for Information and Numerical Data Analysis and Synthesis (CINDAS) data collections would be accepted on a sustainable basis by the engineering community. GRA

N77-28996# Boise Center for Urban Research, Idaho.
AN EXPLORATION OF THE CONCEPT OF REGIONAL DATA CENTERS Final Report
Basil Dahlstrom Feb. 1976 18 p
(Contract HUD-H-2196)
(PB-265636/1; UO-LCCM-BOI-76-003) Avail: NTIS HC A06/MF A01 CSCL 05B

Local governments in the Boise Metropolitan Area are in an early stage of information system development. Greater progress toward useful systems in these individual cases has been inhibited by a lack of technical personnel and financial resources. The technical and economic feasibility of a regional data system serving all of the local governments' functions in the Boise Metropolitan Area is detailed. Further, this report details the preliminary design of technical and procedural detail of such a system as well as a plan for personnel, technology, and resources required to convert general design into specific working reality. GRA

N77-28997# IIT Research Inst., Chicago, Ill.
ENHANCING THE RETRIEVAL EFFECTIVENESS OF LARGE

INFORMATION SYSTEMS Final Report, 1 Jun. 1975 - 31 Dec. 1976
David S. Backer and Sharon R. Pyrce 31 Jan. 1977 162 p refs
(Grant NSF SIS-75-16262)
(PB-266008/2; IITRI-C6345-FR) Avail: NTIS HC A08/MF A01 CSCL 05B

The concept of a sequential search screen was developed in which inexpensive steps are performed first and more expensive ones are later applied to only the limited sets formed by the earlier steps. Context derived intellectual term classes were studied as a means of building user selected concept driven record clusters. A mathematical model for these techniques was derived. Interfaces were suggested whereby succeeding steps of a sequential search could incorporate techniques of artificial intelligence, including semantic and syntactic information processing. GRA

N77-28998# National Commission on New Technological Uses of Copyrighted Works, Washington, D. C.
TRANSCRIPT OF CONTU MEETING NO. 13
Apr. 1977 347 p Meeting held at New York, 31 Mar. - 1 Apr. 1977
(PB-266277/3; CONTU-77-0003) Avail: NTIS HC A15/MF A01 CSCL 05B

Testimony is presented on the AAP proposal for a copy payment center for authorized photocopying; on publishing and reprint sales activities of AIP; on licensing, sampling and payment system; on the BMI sampling, licensing and payment system; on the problems encountered by newsletter publishers when their articles and documents are photocopied; and on computer and photocopying copyright issues from the point of view of the general public. GRA

N77-28999# American Inst. of Physics, New York.
DATA-DESCRIPTIVE RECORDS IN THE PHYSICAL SCIENCES
Rita G. Lerner, Robert Feinman, Irving Lieblich, and Samuel Schiminovich Jul. 1976 102 p refs
(Grant NSF GN-41763)
(PB-266770/7; AIP-76-1) Avail: NTIS HC A06/MF A01 CSCL 05B

A form was designed for use by authors in assigning data tags and flags to their manuscripts, and instructions for filling out the form were drawn up. The data flags are broad categories, chosen from the higher levels of AIP's hierarchical Physics and Astronomy Classification Scheme. Samples of tagged and flagged articles were circulated to data centers and editors; the final version of the form represents the consensus. The data tags are in a faceted, free-language format; each piece of data to be described uses a combination of facets in a prescribed order. The method proposed is applicable to all areas of physics, and could be extended to other sciences and engineering. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N77-29000# Army Electronics Command, Fort Monmouth, N. J. Product Assurance Directorate.
OPTIMAL SYSTEM SPARE CONFIGURATION BASED ON THE PRESENT WORTH OF OPERATIONAL COSTS UNDER A POLICY OF CANNIBALIZATION Final Research Report, Aug. 1973 - Aug. 1976 Ph.D. Thesis - Texas A and M Univ.
John P. Solomond Feb. 1977 203 p refs
(AD-A038110; ECOM-4477) Avail: NTIS HC A10/MF A01 CSCL 15/5

An economic model is developed for determining optimal spare provisioning requirements when a system is subject to cannibalization; in this context, cannibalization is defined as the process of using the good components of a terminally failed unit as a source of replenishment spares for future component failures in other units. The model analyzes four components of a system's net operational costs: the manufacturing or procurement costs, the repair/replacement costs, the cannibalization costs, and a compensating revenue or return function, which is treated as a negative cost. The net cost is explicitly a function of the number of multi-component units deployed, the spare configuration for each component type, the time period over which the system is to be used, and the continuous annual interest rate. The model is representing a worth analysis, which reduces all future costs and revenue to a single equivalent present value. Consequently, alternative spare configurations must be compared over the same period of time. The author develops a stochastic analysis of the repair/replacement and cannibalization processes, and derives general formulas for the time dependent repair/replacement, and cannibalization probability; the expressions are based upon general failure and replacement density functions. GRA

N77-29001# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
OPEC AND THE MONOPOLY PRICE OF WORLD OIL (WORLD OIL PROJECT)
Jacques Cremer and Martin L. Weitzman Apr. 1976 22 p refs
(Grant NSF SIA-75-00739)
(PB-265015/8; MITEL76-015WP; NSF/RA-760476) Avail: NTIS HC A02/MF A01 CSCL 21D

A dynamic model is presented of the behavior of OPEC viewed as a monopolist sharing the world oil market with a competitive sector. In order to study the influence of long term considerations on the price of oil, a dynamic model of the capital theoretic type was built. GRA

N77-29002# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN INVESTIGATION OF THE FORECASTING OF AERONAUTICAL PRICE INDICES M.S. Thesis
Thomas P. Lennertz Dec. 1976 116 p refs
(AD-A036463; GOR/SM/76D-9) Avail: NTIS HC A06/MF A01 CSCL 05/3

An investigation of the forecasts of aeronautical price indices done by the Aeronautical Systems Division (ASD) of the Air Force Systems Command was performed. The historical price indices used by ASD were recalculated. Using these recalculated composite price indices, different forecasting techniques were examined. When starting with the composite price indices, the per cent change regression, with the Gross National Product price deflator as the only independent variable, was recommended as the best forecasting technique. Prediction intervals were calculated. The effect of errors in the Wharton Econometric Forecasting Associates prediction of the Gross National Product price deflator was discussed. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N77-29003*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COSTS AND ENERGY EFFICIENCY OF A DUAL-MODE SYSTEM

R. C. Heft Apr. 1977 76 p refs
(Contracts UMTA-RD-CA-06-0088; DOT-AT-60008)
(NASA-CR-154251; JPL-77-34; UMTA-RD-CA-06-0088-76-2)
Avail: NTIS HC A05/MF A01 CSCL 05C

The life cycle costs of a dual mode system for both public and semiprivate ownership are examined, and the costs in terms of levelized required revenue per passenger mile are presented. The energy use of the dual mode vehicle is analyzed by means of a detailed vehicle simulation program for the control policy and guideway system. Several different propulsion systems are considered. Author

N77-29004# National Academy of Engineering, Washington, D. C.

US TECHNOLOGY AND INTERNATIONAL TRADE

1976 115 p refs Proceedings of the Tech. Session at the 11th Ann. Meeting, Washington, D. C., 23-24 Apr. 1975
(PB-264829/3; NAE-AnMtg-1975) Avail: NTIS HC A06/MF A01 CSCL 05C

Papers presented at a public meeting and dealing with some major issues underlying the relationship of U.S. technology and international trade included: Introduction; Technology and Trade--Public Policy Issues: Technology and Trade--The High Technology Company; The Chemical Process Industries in International Investment and Trade; Case Studies--Electronics--Japan, and Export-Import Bank; Panel Presentations--Mechanism for Policy Concerning Industrial Technology; Summation. GRA

N77-29005# Connecticut Univ., Storrs. Inst. of Water Resources.

ADDITION OF POWDERED ACTIVATED CARBON TO ACTIVATED SLUDGE REACTORS Technical Report, Jul. 1974 - Dec. 1976

H. E. Klei and D. W. Sundstrom Jul. 1977 43 p refs
(Contract DI-14-31-0001-5007)
(PB-264887/1; W77-05723; OWRT-A-057-CONN(1)) Avail: NTIS HC A03/MF A01 CSCL 13B

Activated sludge reactors were subjected to a variety of feed upsets, and powdered carbon was applied as a control mechanism. With glucose as the substrate, addition of carbon only slightly moderated concentration changes during the transient period but decreased the steady state total organic carbon concentrations significantly. Phenol impulses up to 1,000 mg/l and phenol steps up to 250 mg/l did not have adverse long term effects on the bacteria whereas a phenol step of 1,000 mg/l killed the culture. For impulse inputs of phenol, the simultaneous addition of carbon greatly reduced the magnitude of the transient changes in concentration. With step inputs of phenol carbon addition rapidly lowered the phenol concentration in the reactor and permitted continuous operation with inlet phenol concentrations above 1,000 mg/l. GRA

N77-29006# Texas Municipal League, Austin.

MANAGEMENT ASSISTANCE FOR TEXAS CITY GOVERNMENTS. VOLUME 2 APPENDICES D-E: BUILDING CITIZEN SUPPORT IN TEXAS CITIES. A HANDBOOK FOR CITY OFFICIALS AND AN ASSISTANCE GUIDE Final Report, 1974-1976

May 1976 233 p refs Prepared in cooperation with Texas A and M Univ., College Station
(Contract Hud-H-2182)
(PB-264865/7) Avail: NTIS HC A11/MF A01 CSCL 13B

During an 18-month period beginning in 1974, eight projects tested approaches to improving the overall policy development and management capacity of local elected and appointed officials. The demonstration had a dual thrust-making changes at the local level and organizing resources for assistance. The citizen support documents were produced to facilities the transfer of capacity-building methods from one city to another. The Handbook for City Officials provides in depth introduction to public information and citizen participation. It is intended to serve as a text for training and a tool for officials and administrators to use in building effective citizen communications programs. The Assistance Guide provides a step by step approach to identifying communication factors in a city organization. It can be used by either assistance organizations or city officials to guide organizational analysis and to plan a specific work plan for improvement. GRA

N77-29007# Stanford Research Inst., Menlo Park, Calif. Center for Resource and Environmental Systems Studies.

THE POTENTIAL FOR REUSABLE HOMOGENEOUS CONTAINERS Interim Report

Richard L. Goen, Robert V. Steele, Laszlo P. Somogyi, and Norman Fishman Feb. 1977 56 p refs
(Grant NSF AER-76-02396; SRI Proj. EGU-5674)
(PB-265100/8; SRI/CRESS-17; NSF/RA-770030) Avail: NTIS HC A04/MF A01 CSCL 13B

The feasibility of reusable containers for food products (excluding beverages) is examined. The conclusions of the many studies of reusable beverage containers are reviewed along with the food packaging share of the packaging market, the contribution of food packaging to the generation of solid waste, and the quantities of food used in the food service industry. Concepts for reusable food containers--glass or plastic are presented including two types of systems for the return of the containers after use. The total energy use for a glass reusable container system, and for one configuration and size of a plastic reusable container system is derived. GRA

N77-29008# Missouri Water Resources Research Center, Columbia.

BIOLOGICALLY MEDIATED WATER QUALITY DETERIORATION IN DISTRIBUTION SYSTEMS Completion Report 1 Jul. 1975 - 30 Jun. 1976

John T. OConnor, Sai Hyun Lee, William Knocke, and Michael Collins 30 Jun. 1976 55 p refs
(Contract DI-14-34-0001-6026)
(PB-265175/0; W77-05928; OWRT-A-088-MO(1)) Avail: NTIS HC A04/MF A01 CSCL 13B

Water quality deterioration was studied. Field surveys indicated a high iron concentration and depleted dissolved oxygen concentrations in the distribution system. High bacterial counts in distribution systems were noted. Therefore, a continuous chlorination method was chosen to remedy the water quality problems. Both sulfate-reducing bacteria and iron-transforming bacteria were found even after the chlorination program. A survey questionnaire was sent to 250 Missouri water suppliers and rural water districts to determine the extent of water quality problems in distribution systems. GRA

N77-29009# Michigan Univ., Ann Arbor. Inst. of Public Policy Studies.

TOWARD A THEORY OF INNOVATION Final Report

George W. Downs, Jr. and Lawrence B. Mohr Feb. 1977 41 p refs
(Grant NSF PRA-76-19803)
(PB-264908/5; Discussion-Paper-92; NSF/PRA-7619803-1-7) Avail: NTIS HC A03/MF A01 CSCL 05A

A particular subset of innovations suitable for initial empirical studies is examined. A set of explanatory variables, operational measures of these variables, and the alternative variables considered are described. Emphasis is placed on technological innovation in government organizations. GRA

N77-29010# Columbia Univ., New York. Conservation of Human Resources Projects.

SUBURBANIZATION AND THE CITY Final Report

Thomas Stanback, Jr. and Richard Knight Allanheld, Osmun, and Co. Aug. 1976 245 p refs
(Contract DL-21-36-76-18)
(PB-266013/2; DLETA-21-36-76-18-1; ISBN-0-87663-800-0) Avail: NTIS HC A11/MF A01 CSCL 13B

The processes of suburbanization and how they affect labor markets of both cities and their outlying areas were examined. Census of Population materials and the Social Security Continuous Work History file were utilized. It was found that the experience of central cities has been one of difficult transition involving both job gains in office activity and losses in manufacturing and local consumer oriented activities. The transition has been especially difficult for minority male workers because of the sharp rise of female labeled office jobs in the city and the importance of suburb-to-city commuting which provides a supply of white collar workers. The suburban job market itself tends to consist of two sharply contrasting types of employment: one comprised largely of low-skill, low wage jobs in local services; the other, of relatively well paid manufacturing employment along with

selected managerial and professional positions. The best evidence indicates that the lower paid jobs draw their supply largely from wives and younger members of middle income suburban families. Of particular importance to the suburban economy is the flow of income generated by the large corps of commuters to the city. GRA

N77-29011# Federal Highway Administration, Washington, D.C. Office of Highway Planning.

APPLICATIONS OF NEW TRAVEL DEMAND FORECASTING TECHNIQUES TO TRANSPORTATION PLANNING. A STUDY OF INDIVIDUAL CHOICE MODELS

Bruce D. Spear Mar. 1977 163 p refs

(PB-265718/7; FHWA/PL-77012) Avail: NTIS HC A08/MF A01 CSCL 13B

Individual choice (disaggregate) travel demand models in urban transportation planning are applied to: (1) the traditional travel demand process; (2) short range transportation systems management evaluation; and (3) patronage and revenue forecasting for new transportation systems. For each application the suitability of the model is discussed, recent applications are summarized, and two detailed case studies are presented to demonstrate how the models were used. A short primer on individual choice models is included to provide the planner with enough information to understand how the models work and their differences from more conventional planning models. References are given for those who would like to know more about individual choice models. GRA

N77-29012# General Tire and Rubber Co., Akron, Ohio.

INDUSTRIAL WASTEWATER RECLAMATION WITH A 400,000-GALLON-PER-DAY VERTICAL TUBE EVAPORATOR Final Report

William C. Lang, John H. Crozier, Frank P. Drace, and Keith H. Pearson Oct. 1976 110 p refs

(PB-265361/6; EPA-600/2-76-260) Avail: NTIS HC A06/MF A01 CSCL 13B

A vertical tube evaporator (VTE) was built to recover water from a synthetic rubber manufacturing plant wastewater stream containing 3,500 ppm dissolved solids, mostly chlorides and sulfates, and organics in excess of 100 ppm. Continuous operation for extended periods was rendered impossible, due to fouling and corrosion of copper alloy heat exchange surfaces. Corrosion was traced to presence of 2 to 5 ppm of sulfides in the wastewater feed. Unit was retubed with titanium. This eliminated the corrosion, but the fouling continued. All attempts to reduce fouling by pretreating the wastewater feed stream were unsuccessful. GRA

N77-29013# Institute for Defense Analyses, Arlington, Va.

ECONOMIC CHARACTERISTICS OF THE URBAN PUBLIC TRANSPORTATION INDUSTRY Final Report

John D. Wells, Norman J. Asher, Marilyn R. Flowers, Murry E. Kamrass, and Gary R. Nelson Feb. 1972 440 p refs

(Contract DOT-OS-10017)

(PB-265325/1; DOT/TPI/10-77/09) Avail: NTIS HC A19/MF A01 CSCL 13B

Economic characteristics of the urban bus, rail rapid, commuter rail, and taxicab industries are considered. An econometric model of urban bus transit was developed, regulatory constraints and their implications were reviewed, and external effects of urban transit operations such as air and noise pollution and accident were analyzed. The analyses tended to be rather general, concluding that demand deficiency, especially for bus transit, was the main cause of the economic difficulties of urban transit systems. GRA

N77-29014# Massachusetts Inst. of Tech., Cambridge. Center for Transportation Studies.

DEVELOPMENT OF AN AGGREGATE MODEL OF URBANIZED AREA TRAVEL BEHAVIOR: PHASE 1

Frank S. Koppelman, Moshe Ben-Akiva, and Thawat Watanatada Apr. 1976 87 p refs

(Contract DOT-OS-50001)

(PB-265324/4; DOT/TRI/10-77/10) Avail: NTIS HC A05/MF A01 CSCL 13B

An aggregated travel demand model was developed for use in an urbanized area prediction. The model is designed to be applied in the context of the Department of Transportation TRANS model and is based on the aggregation to the urban area wide level of disaggregate travel demand models. Phase I of the project was concerned with the investigation of alternative aggregation procedures. The results of this theoretical and empirical investigation are summarized. GRA

N77-29015# Public Technology, Inc., Washington, D. C.

URBAN TECHNOLOGY SYSTEM (UTS). PHASE 3: OPERATIONS. SUPPLEMENT TO ANNUAL REPORT Annual Report, 1 Jul. 1974 - 30 Jun. 1975

15 Mar. 1976 43 p

(Contract NSF C-834)

(PB-265140/4; NSF/RA-760466) Avail: NTIS HC A03/MF A01 CSCL 13B

A nationwide experiment designed to test technology innovation in local government is described. The program objectives are outlined, and the results of the first year are summarized. The specific areas of innovation are defined, and the problems encountered during the first year are presented. The methods of data collection and analysis including the elements of data collected, initial survey results, and the status of system data collection are also presented. Budget information is included as well. Finally, a first year assessment is given, along with the objectives for the second operational year. GRA

N77-29016# Xerox Electro-Optical Systems, Pasadena, Calif.

A TECHNOLOGY ASSESSMENT OF ADVANCES IN SCIENTIFIC AND TECHNICAL INFORMATION SERVICES Final Report

Donald C. Winter, Donald E. Stewart, and Nilo Lindgren Mar. 1977 169 p refs

(Contract NSF C-1018)

(PB-265839/1) Avail: NTIS HC A08/MF A01 CSCL 05B

Advances in scientific and technical information (STI) services are postulated for: microform publications; fulltext files, machine-readable submission for publication: copyright changes: demand publishing; library automation; and high-speed high-quality facsimile. Possible secondary and higher order impacts of such advances are indentified and weighed as to whether they are of concern or no-concern to society. A summary of the current (1975) technology applicable to STI services is presented. Recommendations for possible future programs and studies in this area are also included. GRA

N77-29017# Patent and Trademark Office, Washington, D. C. Office of Technology Assessment and Forecast.

TECHNOLOGY ASSESSMENT AND FORECAST REPORT (7TH) Semiannual Report

Mar. 1977 225 p

(PB-265792/2) Avail: NTIS HC A10/MF A01 CSCL 05B

The U.S. patent activity in 16 technological areas experiencing either high rates of growth of unusually heavy patenting by residents of foreign countries is examined. Historical trends in U.S. patenting and trademark registration are reviewed. International patenting patterns are reviewed. International patenting patterns are treated in distributions of data relating to patents granted by foreign nations. An in depth examination of patenting in computer memory technology is presented. Pending patent application data are used to forecast patenting in selected technologies. Extensive tables are included which present historic patent data never before available in a single publication. GRA

N77-29018# State Univ. of New York, Syracuse. Coll. of Environmental Science and Forestry.

TESTING EMERGING LAND USE CONCEPTS IN AN URBANIZING REGION. TDR: THE LEGALITY, THE ECONOMICS, THE ADMINISTRATION

Robert D. Hennigan, Robert M. L. Bellandi, Bruce H. Gorelick, David Whitehead, and Shirley A. Farricy 28 Apr. 1977 87 p refs Sponsored by the US Forest Service and Rockefeller Foundation

(PB-265746/8; B24-77-4-28) Avail: NTIS HC A05/MF A01 CSCL 13B

Transfer of Development Rights (TDR) has been offered as a panacea for a burgeoning number of land use problems such as the preservation of farm land, parks, landmarks and environmentally sensitive areas. A thorough objective analysis of the few

cases involving TDR and an overview of related legal issues are presented. Following this is a section dealing with the economic implications of instituting TDR on those directly involved and the general public. A final chapter discusses considerations necessary in the administration of TDR. GRA

N77-29019# Transportation Systems Center, Cambridge, Mass.
TRANSPORTATION STATISTICAL DATA AND INFORMATION Final Report, Jul. 1975 - Dec. 1976
Robert Tap and Alan Kaprelian Dec. 1976 222 p
(PB-265457/2; DOT-TSC-OST-76-60) Avail: NTIS
HC A10/MF A01 CSCL 13B

Internal and external sources of transportation data and statistics especially created for data administrators are reviewed. Organized around the transportation industry and around the elements of the U.S. Department of Transportation, it is the most comprehensive single document that reviews transportation data and its history. GRA

N77-29020# Environmental Protection Agency, Cincinnati, Ohio. Office of Research and Development.
PROCEEDINGS UNITED STATES/JAPAN 4TH CONFERENCE ON SEWAGE TREATMENT TECHNOLOGY
Oct. 1976 681 p refs Conf. held at Cincinnati, 23-24 Oct. 1975, and Washington, D. C., 28-29 Oct. 1975
(PB-265634/6; EPA-600/9-76-023) Avail: NTIS
HC A99/MF A01 CSCL 13B

Joint interests in environmental matters between the United States and Japan were discussed at the fourth conference on sewage treatment technology. Subject matter covered includes sludge treatment and disposal, automation and instrumentation, advanced waste treatment, planning and management of wastewaters, storm and combined overflows, and industrial waste treatment. GRA

N77-29021# Environmental Protection Agency, Washington, D. C. Div. of Water Planning.
RESIDUAL WASTE MANAGEMENT RESEARCH AND PLANNING PROJECTS
Michael L. Rucker and Alan K. Vitberg Feb. 1977 430 p refs
(PB-266201/3; EPA-440/1-77-000) Avail: NTIS
HC A19/MF A01 CSCL 13B

This Residual Waste Management Research and Planning Projects Handbook contains selected abstracts of projects that are underway or have been completed, and publications that are available on the subject of residual wastes and their impact on ground and surface waters are presented. The abstracts are arranged by types of residual waste, i.e., sludge, liquids, and solids. The types are further categorized into the various kinds, i.e., commercial wastes, municipal wastes, industrial wastes, mining wastes, etc. The abstracts are cross-referenced where necessary. GRA

N77-29022# Minnesota Univ., Minneapolis. Water Resources Research Center.
THE REMOVAL OF ORGANIC MATTER FROM WATER SUPPLIES BY ION EXCHANGE
Claude Anderson and Walter J. Maier Feb. 1977 59 p refs
(PB-266022/3; WRRC-Bill-91; OWRT-A-030-MINN (3); W77-06760) Avail: NTIS HC A04/MF A01 CSCL 13B

Quantitative information on the use of anion exchange resins for organic removal is presented. The organics that are present in surface waters which currently pass through conventional treatment could be removed by anion exchange with the use of strongly basic anion exchange columns. The organics were removed to the lower limits of detection of the total organic carbon analysis with the use of the high porosity strongly basic resins. These resins were also easily regenerated with the use of sodium chloride. The selectivity and kinetics of the chloride versus organic exchange process was briefly investigated. A preliminary plant design showed that the process would be economically feasible and competitive with alternate methods of organic removal, assuming that they would also be as effective at organic removal as ion exchange. GRA

N77-29023# Mitre Corp., Bedford, Mass.
WRAP: A MODEL FOR REGIONAL SOLID WASTE MANAGEMENT PLANNING: USERS GUIDE
Edward B. Berman Feb. 1977 130 p
(Contract EPA-68-01-2976)
(PB-266220/3; EPA-530/SW-573) Avail: NTIS
HC A07/MF A01 CSCL 13B

A user's guide is presented to assist individuals or groups of individuals using the WRAP computer program for the decision making process in planning regional solid waste disposal. The model is fully described in terms of its makeup and equation structure to familiarize the users with its capabilities. The kinds of data required for its use are described as well as their preparation and utilization. Examples of prepared data inputs are provided as well as a guide to the design and operation of the model. GRA

N77-29024# North Carolina Univ., Chapel Hill. Dept. of City and Regional Planning.
OPEN SPACE AND URBAN WATER MANAGEMENT. PHASE 2: CASE STUDIES AND FINDINGS
Karl Elfers and Maynard M. Hufschmidt Dec. 1976 138 p refs Prepared in cooperation with N. C. Water Resources Res. Inst., Raleigh.
(Contract DI-14-31-0001-5101)
(PB-266087/6; UNC-WRRI-76-122; W77-06917; WRT-B-086-NC(1)) Avail: NTIS HC A07/MF A01 CSCL 13B

A detailed examination was made of local goals, criteria, and planning strategies for the preservation of open space and the related management of urban water resources. The key elements are two extensive case studies of small, urbanizing watersheds in the Piedmont Region of North Carolina. The two watersheds offer good examples of the diverse problems, issues, goals, and criteria that may be involved in open space preservation and related urban water management. Crabtree Creek watershed, near and including part of Raleigh, N.C., offers a case study. GRA

N77-29025# Association of Montery Bay Area Governments, Calif.
A TECHNIQUE TO ASSIST CITIZEN GROUPS IN DECISION MAKING
Harold Chatland 1976 45 p
(Grant NSF GI-35995-1)
(PB-265742/7; NSF/RA-760263) Avail: NTIS
HC A03/MF A01 CSCL 13B

A method to help interested citizens take part in the resolution of issues confronting them is described and applied to the problem of urban core revitalization, (although it may be tailored to fit other issues). The elements of this technique include: (1) an impact analysis worksheet that lists factors likely to be affected by suggested solutions to the problem to be resolved; (2) a suggested procedure for employing the technique; (3) directions for the preparation of an impact analysis worksheet to suit the particular situation; (4) the types of information necessary to evaluate the side effects and how this information may be acquired; and (5) some ways to stimulate elected officials to take action on the recommendations resulting from the analysis. GRA

N77-29026# Wendell Associates, McLean, Va.
FEDERAL ASSISTANCE PROGRAMS AND ENERGY DEVELOPMENT-IMPACTED MUNICIPALITIES
Washington FEA Feb. 1976 112 p refs
(Contract FEA-CO-04-60431-00)
(PB-265804/5; FEA/D-77/039) Avail: NTIS
HC A06/MF A01 CSCL 13B

Federal assistance programs which do or could provide aid for small communities impacted by major energy development are identified. It is also intended to analyze other programs of assistance to local governments to show why they are not presently suitable for use by these communities, and to indicate what kinds of changes would be necessary to make them useful to such communities. GRA

N77-29027# Midwest Research Inst., Kansas City, Mo.
CHEMICAL TECHNOLOGY AND ECONOMICS IN ENVIRONMENTAL PERSPECTIVES. TASK 4: ACTIVATED CARBON Final Report, Oct. - Dec. 1976
Gary L. Kelso and Thomas W. Lapp Feb. 1977 36 p refs

(Contract EPA-68-01-3201)
(PB-266181/7; EPA-560/2-77-002) Avail: NTIS HC A03/MF A01 CSCL 07A

Selected information is presented concerning the manufacture and use of activated carbon, with particular emphasis on product quality as related to the presence of heavy metal ions and/or polynuclear aromatic compounds. Specific areas of interest were the raw materials and methods of production; manufacturers, production capacities, and actual production; types of final products; and consumption patterns of activated carbon. Product quality specifications for heavy metal ions and polynuclear aromatic compounds in the final products were investigated. U.S. production quantities have exceeded 200 million pounds annually for the past 3 to 4 years. Of the estimated 180 million pounds consumed in the United States in 1975, about 37% was employed in food and pharmaceutical areas, 25% in water or waste treatment processes, and 38% in other applications. Activated carbon for use in foods and pharmaceuticals conforms to the Food Chemicals Codex specifications for heavy metal ions and polynuclear aromatics. Products for municipal water treatment are subject to AWWA standards. Activated carbon for other uses are subject only to customer specifications. GRA

N77-29028# Weston (Roy F.), Inc., West Chester, Pa.
A REVIEW OF TECHNIQUES FOR INCINERATION OF SEWAGE SLUDGE WITH SOLID WASTES Final Report, 4 Jun. 1974 - 5 Sep. 1976
W. Niessen, A. Daly, E. Smith, and E. Gilardi Dec. 1976 238 p refs
(Contract EPA-68-03-0475)
(PB-266355/7; EPA-600/2-76-288) Avail: NTIS HC A11/MF A01 CSCL 13B

European and American practice is described. Four co-incineration techniques are evaluated for thermodynamic and economic feasibility; pyrolysis, multiple hearth, direct drying, and indirect drying. Each process is compared with conventional separate incineration with respect to cost, practicality, and project environmental impact. Recommendations for specific demonstrations are made and EPA endorsement of co-incineration is proposed. GRA

N77-29029# Clean Water Consultants, El Dorado, Calif.
COST ESTIMATING MANUAL: COMBINED SEWER OVERFLOW STORAGE AND TREATMENT Final Report
Henry H. Benjes, Jr. Dec. 1976 136 p refs
(Contract EPA-68-03-2186)
(PB-266359/9; EPA-600/2-76-286) Avail: NTIS HC A07/MF A01 CSCL 13B

An example of the use of the data is given. Estimated average construction costs and operation and maintenance requirements are related graphically to appropriate single parameters for respective plant components. In addition, cost components of the process functions are presented to enable inflating cost-related materials and wages. The data presented provides means of estimating costs and operating and maintenance requirements for a variety of facilities on an average basis, but do not supplant the need for detailed study of local conditions or recognition of changing design requirements in preparing estimates for specific applications. GRA

88 SPACE SCIENCES (GENERAL)

N77-29030*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPECTRAL ANALYSIS OF A HIGH-VELOCITY METEOR
Gale A. Harvey Washington Jul. 1977 23 p refs
(NASA-TN-D-8505; L-11433) Avail: NTIS HC A02/MF A01 CSCL 03B

A spectrogram of a fast optical meteor was reduced and analyzed, and 60 features were identified in the spectrum. Air and ionized elements in this meteor radiate throughout the spectrum from 3000 A to 6800 A. A mass of 9 mg and an effective radiation temperature of approximately 5700 K were computed for the meteor. Weight ratios of Ca:Fe, and Mg:Fe, and Na:Fe were computed. A plasma particle velocity distribution for meteors was derived, and the average collision speed obtained from this distribution was compared with the relative collision speed of a Fe-N2 gas mixture at 5700 K. Author

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N77-29031 California Inst. of Tech., Pasadena.
THE NATURE OF MARKARIAN GALAXIES AND STUDIES OF STAR FORMATION IN BLUE GALAXIES Ph.D. Thesis
John Peter Hucwra 1977 192 p
Avail: Univ. Microfilms Order No. 77-3132

Integrated UBV photometry for 197 non-Seyfert Markarian galaxies was compared with existing photometry of field galaxies. The distributions of galaxy colors overlap by almost 75% and the color-color relations are the same. The color-aperture relations derived from multiaperture observations show that the Markarian galaxies generally get bluer towards their centers, unlike all but the latest types of field galaxies. Thirteen binary galaxies with good radial velocity data were used to derive the mean minimum mass to light ratio for Markarian galaxies. The Markarian galaxy luminosity function was also derived, and a crude estimate was made of the space density as a function of color for both Markarian and field galaxies. Models of galaxies were constructed with a variety of star formation histories and initial mass functions. Comparisons of model predictions with the observed metal abundance, color-magnitude distribution, and internal reddening led to the conclusion that a 'composite' model is most appropriate; i.e., a galaxy more than 10 to the 10th power years old, with recent bursts of star formation. Dissert. Abstr.

N77-29032 Texas Univ., Austin.
BLACK HOLE: NEUTRON STAR BINARY SYSTEMS Ph.D. Thesis
James Michael Lattimer 1976 113 p
Avail: Univ. Microfilms Order No. 77-3937

The formation of black hole - neutron star binaries was investigated. The possibility that X-ray sources may be the progenitors of compact binary systems, i.e., those containing black hole and/or neutron stars was considered. Models for the tidal disruption of a neutron star in the process of colliding with a black hole were constructed, which indicate that the breakup may be violent enough to eject a fraction (5% or less) of the neutron star completely out of the system. The composition of the ejected neutron star matter, which undergoes decompression from nuclear densities was analyzed. It was found that virtually no deuterium can be created. Heavy neutron rich nuclei are formed including, possibly, the superheavies of atomic number around 114. A statistical estimate for the frequency of black hole - neutron star collisions was made. The possible implications for nucleosynthesis, antineutrino emission, and gamma ray bursts are discussed. Dissert. Abstr.

N77-29033 Indiana Univ., Bloomington.
SYNTHETIC COLOR-MAGNITUDE DIAGRAMS FOR METAL POOR GLOBULAR CLUSTERS Ph.D. Thesis
Robert Michael Marksteiner 1976 179 p
Avail: Univ. Microfilms Order No. 77-1917

A technique was developed which allows meaningful interpolations among a series of evolutionary sequences for metal poor stars of different mass composition and mixing length. The evolutionary sequences were computed using a modified version of the Paczynski stellar evolution code with an improved treatment of hydrogen burning. While the assumption of equilibrium hydrogen burning was maintained, a number of modifications were made in the treatment of energy generation: (1) all reaction rates for the PP chain were updated to 1974 values; (2) the branching correction in the proton-proton cycle was included; (3) electron screening was included in the weak screening limit; and (4) the technique used to calculate the amount of hydrogen burnt during each time step in the star's evolution was modified. Dissert. Abstr.

N77-29034 Indiana Univ., Bloomington.
AN OBSERVATIONAL STUDY OF THE PHYSICAL CONDITIONS IN RED GIANT ATMOSPHERES Ph.D. Thesis
Lawrence William Ramsey 1976 140 p
Avail: Univ. Microfilms Order No. 77-1929

The temperature structure and ionization balance in the atmospheres of red giant stars was investigated. Particular attention was given to the giant star Aldebaran (K5 III). The observational basis for all studies was moderate to high resolution photoelectric spectrophotometry of various atomic lines. A technique was developed to obtain the run of excitation temperature (Texc) with height in a stellar atmosphere from the central fluxes of atomic lines in a single multiplet. Source function equality for all lines in a multiplet and the dominance of the line over the continuous opacity were assumed. A test of the method for the sun using lines in Fe I multiplet (553) yielded good agreement with independently determined solar model atmospheres. Dissert. Abstr.

N77-29035 State Univ. of New York, Albany.
AN ANALYSIS OF uvby PHOTOMETRY AND ELECTROGRAPHIC vby PHOTOMETRY OF M15 AND M71 Ph.D. Thesis
Lawrence John Relyea 1976 171 p
Avail: Univ. Microfilms Order No. 77-3471

Theoretical Stroumgren uvby and Johnson-Morgan UBV colors were calculated from the Kurucz (1976) grid of model atmospheres for G, F, A, B, and O stars, and calibrated to the standard systems using a model atmosphere for Vega of T sub eff = 9400 K, log g = 3.95. The resulting color-color grids were analyzed, and the usefulness of the photometric systems for derivation of atmospheric effective temperature, surface gravity, and abundance was assessed. Excellent agreement between the models and observations was obtained for T sub eff > or = 8500 K. A discrepancy was found for T sub eff < 8500 K, and possible sources of error were studied. Electrographic vby photometry was obtained for the globular clusters M5 and M71 in the range 14.0 < V < or = 18.0. The y vs. (b-y) color-magnitude diagrams were obtained and the (v-b) and (m sub 1) indices were analyzed. Dissert. Abstr.

N77-29036 Indiana Univ., Bloomington.
UBV SURFACE PHOTOMETRY OF THE GLOBULAR CLUSTERS M3, M5, M13 AND M92 Ph.D. Thesis
Terrence William Raymond Rettig 1976 251 p
Avail: Univ. Microfilms Order No. 77-1932

Contour maps in both magnitude and color have been obtained for the globular clusters M3, M5, M13 and M92 using a UBV photoelectric drift scanning technique. From the contour data, magnitudes and colors for various specified diaphragm sizes and centered annuli have been synthesized for each cluster. These data are in excellent agreement with published data. The synthesized annuli computed from the contour data yield the radial color distribution for each cluster to a radius of approximately 5 arc minutes. The clusters M5 and M13 do not show any detectable radial color gradient. For the cluster M3, the B-V index revealed a small radial gradient. The center of the cluster M3 shows a B-V index 0.04 bluer than the region beyond 2 arc minutes. This effect is probably the result of mass segregation within the cluster. This is in agreement with previous observations of M3 indicating that, of the horizontal branch stars the blue stars are more concentrated to the center. Similarly, theoretical models require a fully relaxed stellar distribution for M3.
Dissert. Abstr.

N77-29037 Illinois Univ., Urbana-Champaign.
LOCAL EXTINCTIONS FOR PLANTARY NEBULAE Ph.D. Thesis
John Richard Doughty 1976 159 p
Avail: Univ. Microfilms Order No. 77-8977

The spectra of several planetary nebulae were studied from high dispersion plates, which show line splitting due to expansion. Measurements of the red/blue intensity ratios as a function of wavelength reveal the possible presence of internal extinction. The dust optical depths are usually a few tenths of a magnitude. Due to observational scatter, the ratios do not always yield conclusively the exact extinction law in the ionized hydrogen, but the results are not inconsistent with a lambda sup 1 law. Theoretical calculations indicate that the results would be compatible with absorption by small graphite grains with dust/gas ratios of 1/100-1/1000. The data also show stratification effects, the possibilities for ionic depletion by dust are investigated as well as two possible mechanisms for the growth of larger than interstellar sized grains. Dissert. Abstr.

N77-29038*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FILM CALIBRATION FOR THE SKYLAB/ATM S-056 X-RAY TELESCOPE
William Henze, Jr. (Teledyne Brown Engineering, Huntsville, Ala.), Robert M. Broussard (Aerospace Corp., El Segundo, Calif.), James H. Underwood (Stanford Univ., Calif.), James P. McGuire, Edwin J. Reichmann, and Jesse B. Smith, Jr. Jul. 1977 35 p refs (NASA-TM-78122) Avail: NTIS HC A03/MF A01 CSCL 03A

The sensitometry and film calibration effort for the Skylab/ATM S-056 X-ray telescope is summarized. The apparatus and procedures used are described together with the two types of flight film used, Kodak SO-212 and SO-242. The sensitometry and processing of the flight film are discussed, and the results are presented in the form of the characteristic curves and related data. The use of copy films is also discussed. Author

N77-29039# Los Alamos Scientific Lab., N. Mex.
PROCEEDINGS OF THE SOLAR AND STELLAR PULSATION CONFERENCE
Arthur N. Cox, comp. and Robert G. Deupree, comp. Oct. 1976 303 p refs Conf. proc. held at Los Alamos, N. Mex., 3-5 Aug. 1976
(Contract W-7405-eng-36)
(LA-6544-C; Conf-760863) Avail: NTIS HC A14/MF A01

The time, observations, and theories of solar and stellar pulsations are discussed in 31 conference papers. Subjects covered include: solar pulsation observation and interpretation, linear and nonlinear theory results, the Goddard (cepheid) model, and material properties. ERA

N77-28760*# Western Kentucky Univ., Bowling Green. Dept. of Physics and Astronomy.
BLACK HOLES AND RELATIVITIC GRAVITY THEORIES
A. J. Fennelly and Richard Pavelle (Logicon, Lexington, Mass.) *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 97-107 refs (For primary document see N77-28750 19-59)
Avail: NTIS HC A25/MF A01 CSCL 03A

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N77-29040 Texas Univ., Austin.
CONSTRUCTION AND SOME PROPERTIES OF THE MOST GENERAL HOMOGENEOUS NEWTONIAN COSMOLOGICAL MODELS Ph.D. Thesis
David Larry Hibler 1976 128 p
Avail: Univ. Microfilms Order No. 77-3913

Homogeneous Newtonian cosmological models are first analyzed. Homogeneous Newtonian cosmologies are defined in terms of symmetry groups. The first type possesses a transitive symmetry group on the spacelike hypersurface defined by setting the time equal to a constant. This type has two subclasses; they correspond to the relativistic classification of Bianchi type I and Bianchi Type VII, with h = 0. In the second type the spacelike hypersurfaces are not perpendicular to the time axis; the first seven of the Bianchi types are possible. Velocity fields and equations of motion are discussed. Higher order perturbation theory is also discussed. The simplest possible background model is assumed, namely, the Newtonian model which is homogeneous and isotropic dust and which has the cosmological constant zero and the quantity analogous to the curvature equal to zero.
Dissert. Abstr.

N77-29041 Princeton Univ., N. J.
ULTRAVIOLET INVESTIGATIONS OF THE INTERCLOUD

MEDIUM AND HIGH VELOCITY INTERSTELLAR GAS Ph.D. Thesis
John Michael Shull 1976 134 p
Avail: Univ. Microfilms Order No. 77-2165

Copernicus satellite UV data on interstellar absorption lines towards Mu Col, HD28497, and HD50896 were analyzed to study the abundances and physical conditions in these lines-of-sight. These stars were chosen because of the low reddening, and hence low mean neutral hydrogen densities in these directions. Nevertheless, a substantial portion of the neutral gas is found to be associated with dense condensations containing H. Profile fitting was employed to determine column densities in many of the components separately. In several high velocity clouds, Fe, Ca, and Si appear to be nearer their cosmic abundances than typical in interstellar gas. This effect may be related to the well-known correlation of the ratio N(Ca II/N(Na I) with cloud velocity. Theories of grain disruption are discussed as they relate to this correlation and the observed Ca, Fe, and Si enhancements. Dissert. Abstr.

N77-28786*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF MACSYMA TO FIRST ORDER PERTURBATION THEORY IN CELESTIAL MECHANICS
John D. Anderson and Eunice L. Lau *In* NASA. Langley Res. Center Proc. of the 1977 MACSYMA Users' Conf. 1977 p 395-404 refs (For primary document see N77-28750 19-59)
(Contract NAS7-100)
Avail: NTIS HC A25/MF A01 CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N77-29042*# Scientific Translation Service, Santa Barbara, Calif.
INVESTIGATIONS OF PRIMARY AND SECONDARY IMPACT STRUCTURES ON THE MOON AND LABORATORY EXPERIMENTS TO STUDY THE EJECTA OF SECONDARY PARTICLES Ph.D. Thesis - Ruprecht Karl Univ.
Beate Koenig Washington NASA Jul. 1977 114 p refs Transl. into ENGLISH of the book "Untersuch. von Primaren und Sekundaeren Einschlagstrukturen auf dem Mond und Labexperimente zum Studium des Auswurfs von Sekundaerteilchen", Heidelberg, 1977 88 p
(Contract NASw-2791)
(NASA-TM-75023) Avail: NTIS HC A06/MF A01 CSCL 03B

Young lunar impact structures were investigated by using lunar orbiter, Apollo Metric and panorama photographs. Measurements on particularly homogeneous areas low in secondary craters made possible an expansion of primary crater distribution to small diameters. This is now sure for a range between 20m < or = D < or = 20km and this indicates that the size and velocity distribution of the impacting bodies in the last 3 billion years has been constant. A numerical approximation in the form of a 7th degree polynomial was obtained for the distribution. Author

N77-29043*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC RATIONALE AND STRATEGIES FOR A FIRST COMET MISSION: REPORT OF THE COMET HALLEY SCIENCE WORKING GROUP
Jul. 1977 92 p
(NASA-TM-78420) Avail: NTIS HC A05/MF A01 CSCL 03B

The science objectives of a first comet mission are reviewed and related to what is known or can be expected to be learned in the near future from ground-based and near earth observations. A set of instruments and their science objectives are defined for a mission to Comet Halley during its 1985/86 apparition. The benefits from a fast flyby, a slow flyby, or a rendezvous mission and the relative impact of each on the instrument payload were assessed. The relative scientific value of encounters with the comet at distances from the sun ranging from 1 AU to 2.5 AU, including possible tradeoffs between flyby velocity and distance was considered. Pre- and post-perihelion encounters were likewise evaluated. Author

N77-29044*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC RATIONALE AND STRATEGIES FOR A FIRST COMET MISSION. REPORT OF THE COMET HALLEY SCIENCE WORKING GROUP. AN EXECUTIVE SUMMARY
Jul. 1977 11 p
(NASA-TM-78420-Pt-2) Avail: NTIS HC A02/MF A01 CSCL 03B

The justification, scientific objectives, instrumentation, and strategy for a first comet mission are discussed. Topics include: mission target; rendezous, propulsion system requirements, measurement objectives, instrument capabilities for rendezvous and the tail probe payload, and backup missions if rendezvous with Halley's comet is not possible to achieve. Support research to be done by NASA is recommended. A.R.H.

N77-29045*# Martin Marietta Corp., Baltimore, Md.
VIKING 75 PROJECT: VIKING LANDER SYSTEM PRIMARY MISSION PERFORMANCE REPORT
C. G. Cooley Apr. 1977 105 p
(Contract NAS1-9000)
(NASA-CR-145148; FR-3770219) Avail: NTIS HC A06/MF A01 CSCL 03B

Viking Lander hardware performance during launch, interplanetary cruise, Mars orbit insertion, preseparation, separation through landing, and the primary landed mission, with primary emphasis on Lander engineering and science hardware operations, the as-flown mission are described with respect to Lander system performance and anomalies during the various mission phases. The extended mission and predicted Lander performance is discussed along with a summary of Viking goals, mission plans, and description of the Lander, and its subsystem definitions. Author

N77-29046*# National Aeronautics and Space Administration, Washington, D. C.
VOYAGER TO JUPITER AND SATURN
1977 62 p
(NASA-SP-420) Avail: NTIS HC A04/MF A01 CSCL 03B

The NASA Voyager mission to explore planets of the outer solar system is summarized. The mission schedule and profiles for encounters with Jupiter and Saturn, and possibly with Uranus and Pluto are included along with a description of the spacecraft and its trajectories. Scientific investigations to be made and the instruments carried are also discussed. A.R.H.

N77-29047*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
RESULTS OF ANALYSES PERFORMED ON SOIL ADJACENT TO PENETRATORS EMPLACED INTO SEDIMENTS AT MCCOOK, NEBRASKA, JANUARY 1976
M. Blanchard, T. Bunch, A. Davis (San Jose State Univ.), F. Kyte (San Jose State Univ.), H. Shade (L.F.E. Corp.), J. Erlichman (L.F.E. Corp.), and G. Polkowski (L.F.E. Corp.) Washington Jul. 1977 30 p refs
(NASA-TN-D-8500; A-6907) Avail: NTIS HC A03/MF A01 CSCL 03B

During 1976 several penetrators (full and 0.58 scale) were dropped into a test site McCook, Nebraska. The McCook site was selected because it simulated penetration into wind-deposited sediments (silts and sands) on Martian plains. The physical and chemical modifications found in the sediment after the penetrators' impact are described. Laboratory analyses have shown mineralogical and elemental changes are produced in the sediment next to the penetrator. Optical microscopy studies of material next to the skin of the penetrator revealed a layer of glassy material about 75 microns thick. Elemental analysis of a 0-1-mm layer of sediment next to the penetrator revealed increased concentrations for Cr, Fe, Ni, Mo, and reduced concentrations for Mg, Al Si, P, K, and Ca. The Cr, Fe, Ni, and Mo were in fragments abraded from the penetrator. Mineralogical changes occurring in the sediment next to the penetrator included the introduction of

micron-size grains of alpha iron and several hydrated iron oxide minerals. The newly formed silicate minerals include metastable phases of silica (cristobalite, lechatelierite, and opal). The glassy material was mostly opal which formed when the host minerals (mica, calcite, and clay) decomposed. In summary, contaminants introduced by the penetrator occur up to 2 mm away from the penetrator's skin. Although volatile elements do migrate and new minerals are formed during the destruction of host minerals in the sediment, no changes were observed beyond the 2-mm distance. The analyses indicate 0.58-scale penetrators do effectively simulate full-scale testing for soil modification effects. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N77-29048*# Stanford Univ., Calif. Inst. for Plasma Research.
GEOMAGNETIC ACTIVITY: DEPENDENCE ON SOLAR WIND PARAMETERS
Leif Svalgaard May 1977 68 p refs
(Grant NGR-05-020-559; Contract N00014-76-C-0207; Grants NSF ATM-74-19007; NSF DES-75-15664)
(NASA-CR-154124; SUIPR-699) Avail: NTIS HC A04/MF A01 CSCL 03B

Current ideas about the interaction between the solar wind and the earth's magnetosphere are reviewed. The solar wind dynamic pressure as well as the influx of interplanetary magnetic field lines are both important for the generation of geomagnetic activity. The influence of the geometry of the situation as well as the variability of the interplanetary magnetic field are both found to be important factors. Semi-annual and universal time variations are discussed as well as the 22-year cycle in geomagnetic activity. All three are found to be explainable by the varying geometry of the interaction. Long term changes in geomagnetic activity are examined. Author

N77-29049*# Stanford Univ., Calif. Inst. for Plasma Research.
COMPARISON OF H ALPHA SYNOPTIC CHARTS WITH THE LARGE-SCALE SOLAR MAGNETIC FIELD AS OBSERVED AT STANFORD
Thomas L. Duvall, Jr., John M. Wilcox, Leif Svalgaard, Philip H. Scherrer, and Patrick S. McIntosh May 1977 15 p refs Submitted for publication
(Grant NGR-05-020-559; Contract N00014-76-C-0207; Grants NSF ATM-74-19007; NSF DES-75-15664)
(NASA-CR-154125; SUIPR-700) Avail: NTIS HC A02/MF A01 CSCL 03B

Two methods of observing the neutral line of the large-scale photospheric magnetic field are compared: (1) neutral line positions inferred from H alpha photographs and (2) observations of the photospheric magnetic field made with low spatial resolution (3 arc min.) and high sensitivity using the Stanford magnetograph. The comparison is found to be very favorable. Author

N77-29050*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
ION-ACOUSTIC WAVES IN THE SOLAR WIND Progress Report
D. A. Gurnett and L. A. Frank Mar. 1977 66 p refs Submitted for publication
(Contracts NAS5-11279; NAS5-11431; NAS5-11064; Grants NGL-16-001-002; NGL-16-001-043; Contract N00014-76-C-0016)
(NASA-CR-153397; AD-A039092; U-Of-Iowa-77-10) Avail: NTIS HC A04/MF A01 CSCL 03/2

Plasma wave measurements on the Helios 1 and 2 spacecraft have revealed the occurrence of electric field turbulence in the solar wind at frequencies between the electron and ion plasma frequencies. Wavelength measurements with the IMP 6 spacecraft now provide strong evidence that these waves are short wavelength ion-acoustic waves which are doppler shifted upward in frequency by the motion of the solar wind. Comparison of the Helios results with measurements from the earth-orbiting IMP 6 and 8 spacecraft shows that the ion-acoustic wave turbulence detected in interplanetary space has characteristics essentially identical to bursts of electrostatic turbulence generated by protons streaming into the solar wind from the earth's bow shock. In a few cases enhanced ion-acoustic wave intensities have been observed in direct association with abrupt increases in the anisotropy of the solar wind electron distribution. This relationship strongly suggests that the ion-acoustic waves detected by Helios far from the earth are produced by an electron heat flux instability, as suggested by Forsiund. Possible related mechanisms which could explain the generation of ion-acoustic waves by protons streaming into the solar wind from the earth's bow shock are also considered. Author (GRA)

N77-29051# Naval Research Lab., Washington, D. C.
A BRIEF REVIEW OF SOME RECENT RESULTS THAT CAN IMPROVE OUR THEORETICAL UNDERSTANDING OF MAGNETIC FIELD RECONNECTION AND THERMALIZATION AS APPLICABLE TO SOLAR FLARES Interim Report
D. S. Spicer Mar. 1977 20 p refs
(AD-A039113; NRL-MR-3465) Avail: NTIS HC A02/MF A01 CSCL 03/2

Some recent theoretical results concerning the phenomenon of reconnection and its relation to solar flares are reviewed. GRA

N77-29052# Stanford Univ., Calif. Inst. for Plasma Research.
FORCE FREE MAGNETIC FIELDS AND SOLAR ACTIVITY Final Report, 1 Jul. 1974 - 31 Dec. 1976
P. A. Sturrock and C. W. Barnes Hanscom AFB, Mass. AFGL Dec. 1976 28 p refs
(Contract F19628-74-C-0054)
(AD-A039944; AFGL-TR-77-0023) Avail: NTIS HC A03/MF A01 CSCL 03/2

This study, aimed at the prediction of solar flares, centers on devising methods for calculating magnetic field structures in the solar atmosphere. Force-free fields comprise an important class of magnetic-field structures which may be calculated by relaxation techniques. Models under active consideration involve spherical boundary surfaces and cylindrical symmetry. Study of the energy of such field configurations indicates that, for sufficiently large shear, force-free fields will be unstable against perturbations leading to eruption. The condition for this instability and the mechanism of instability have been investigated. The studies are related to erupting prominences and coronal transients, as well as solar flares. Author (GRA)

N77-29053# National Center for Atmospheric Research, Boulder, Colo.
A NON-LOCAL-THERMODYNAMIC EQUILIBRIUM FORMULATION OF THE TRANSPORT EQUATION FOR POLARIZED LIGHT IN THE PRESENCE OF WEAK MAGNETIC FIELDS Ph.D. Thesis
Daniel J. McNamara 1977 118 p refs
(Contract NSF C-760)
(PB-265820/1; NCAR-CT-44) Avail: NTIS HC A06/MF A01 CSCL 03B

The changes in polarization, and therefore in the Stokes parameters, due to the transport of a beam through an optically thick medium in a weak magnetic field are considered. The transport equation is derived from a general density matrix equation of motion. This allows the possibility of interference effects arising from the mixing of atomic sublevels in a weak magnetic field to be taken into account. The statistical equilibrium equations are similarly derived. Finally the coupled system of equations is presented and the order of magnitude of the interference effects shown. Collisional effects are not considered. The magnitude of the interference effects in magnetic field measurements of the sun may be evaluated. GRA

N77-29054# National Center for Atmospheric Research, Boulder, Colo.
AN OBSERVATIONAL INVESTIGATION OF LONG PERIOD OSCILLATIONS IN THE APPARENT SOLAR DIAMETER Ph.D. Thesis
Timothy McCain Brown 1977 117 p refs
(Contract NSF C-760)

(PB-265726/0; NCAR-CT-42) Avail: NTIS HC A06/MF A01 CSCL 03B

Observations of the apparent solar diameter were undertaken to determine whether long period oscillations might be present. Power spectrum analyses reveal oscillations thoughtout the 3 to 7 min period range, with typical amplitudes of 2 x 10 to the (-6) power of the solar diameter. It is suggested that the oscillations are normal mode vibrations of the entire sun. A simple theory is presented describing waves in an atmosphere with a constant temperature gradient and Newton's law cooling, and used to demonstrate that the normal modes interpretation is consistent with available observations of temperature and radial velocity, as well as with those of apparent diameter. GRA

N77-29055# National Center for Atmospheric Research, Boulder, Colo.

THE THREE DIMENSIONAL SOLAR CORONA. A CORONAL STREAMER Ph.D. Thesis - Colorado Univ.

Douglas Carl Wilson 1977 292 p refs

(Contract NSF C-760)

(PB-265761/7; NCAR-CT-40) Avail: NTIS HC A13/MF A01 CSCL 03B

The first derivation of the 3-D electron density of a coronal streamer is presented and interpreted in terms of streamer magnetic fields. A single streamer was studied in photographs it had the helmet structure often used to infer a circular cross section, but reconstruction showed it to be extended along the line of sight. Cross sectional area, increasing as (rsup 1.8), showed no minimum at the least apparent width. Average streamer density followed the Newkirk (1967) equatorial density model, with lower densities above 2 RO than in earlier models. Comparison with magnetograms, X-ray photographs, and potential fields showed bipolar field but highest densities outside the neutral sheet. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N77-29056 Texas Univ., Austin.

IDENTIFICATION OF RADIO SOURCES USING ACCURATE RADIO AND OPTICAL POSITIONS Ph.D. Thesis

Francis Dunnington Ghigo 1976 301 p

Avail: Univ. Microfilms Order No. 77-3903

Radio positions of one or two arcsecond accuracy were measured at 365 MHz with a broadband synthesis interferometer (BSI) for a sample of 664 radio sources. The sample included half of all sources in the selected regions of sky between declinations -2 deg and +33 deg having flux densities greater than 0.3 Jy at 1,415 MHz. The National Geographic Society - Palomar Observatory sky survey plates were measured with a laser interferometer to find positions of about 0.5 arcsecond accuracy for all objects in the vicinity of each radio source. Objects in random areas of the plates were counted to estimate the rate of chance coincidences. Of the 48% of the sources identified, half were galaxies, and half were confirmed or probable quasistellar objects. Of the 319 suggested identifications, 206 are coincidences within five arcseconds of the measured radio and optical positions. Dissert. Abstr.

N77-29057*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

ENERGIZATION OF POLAR-CUSP ELECTRONS AT THE NOON MERIDIAN

J. D. Craven and L. A. Frank May 1977 27 p refs

(Contract NAS5-11265; Grant NGL-16-001-002; Contract N00014-76-C-0016)

(NASA-CR-154257; U-of-IOWA-77-19) Avail: NTIS HC A03/MF A01 CSCL 03B

Observations gained with an electrostatic analyzer on board the low altitude, polar orbiting Aeriel 4 satellite demonstrate that the directional, differential spectra of polar-cusp electron intensities are regulated by the sign of the interplanetary magnetic field (IMF) elevation angle. In the energy range 200 is approximately less than E is approximately less than 700 eV, spectra of polar cusp electron intensities were not observed to respond to changes in the sign of the IMF elevation angle. At greater densities, spectra were found to be significantly harder when the IMF angle of elevation was greater than 0 deg, with a factor of approximately 10 typical for 2-keV electron intensities. These enhanced intensities appear to be localized within approximately a one hour sector of magnetic local time centered on the noon meridian. Author

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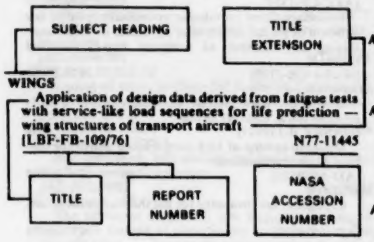

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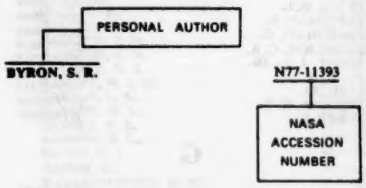

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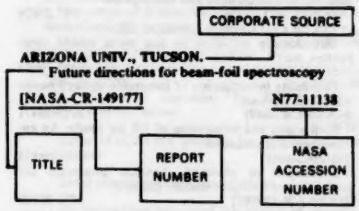

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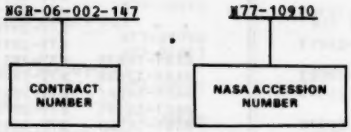

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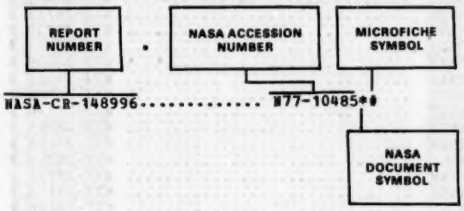

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NASA-TM-78124 ..... N77-28987*#
NASA-TM-78420 ..... N77-29043*#
NASA-TM-78420-PT-2 ..... N77-29044*#

NASA-TN-D-8417 ..... N77-28524*#
NASA-TN-D-8423 ..... N77-28087*#
NASA-TN-D-8425 ..... N77-28180*#
NASA-TN-D-8437 ..... N77-28112*#
NASA-TN-D-8444 ..... N77-28912*#
NASA-TN-D-8454 ..... N77-28124*#
NASA-TN-D-8458 ..... N77-28088*#
NASA-TN-D-8467 ..... N77-28564*#
NASA-TN-D-8468 ..... N77-28967*#
NASA-TN-D-8475 ..... N77-28091*#
NASA-TN-D-8477 ..... N77-28911*#
NASA-TN-D-8479 ..... N77-28092*#
NASA-TN-D-8480 ..... N77-28137*#
NASA-TN-D-8481 ..... N77-28061*#
NASA-TN-D-8496 ..... N77-28138*#
NASA-TN-D-8500 ..... N77-29047*#
NASA-TN-D-8501 ..... N77-28251*#
NASA-TN-D-8503 ..... N77-28093*#
NASA-TN-D-8505 ..... N77-29030*#
NASA-TN-D-8510 ..... N77-28139*#
NASA-TN-D-8515 ..... N77-28525*#
NASA-TN-D-8522 ..... N77-28062*#
NASA-TN-D-8524 ..... N77-28094*#
NASA-TN-D-8527 ..... N77-28588*#

NASA-TT-F-17429 ..... N77-28067*#

NAVTRAEQUIPC-75-C-0101-1 ..... N77-28748 #

NBS-BSS-96 ..... N77-28687 #

NBS-MONO-147-SUPPL-1 ..... N77-28376 #

NBS-SP-45 ..... N77-28344 #
NBS-SP-400-29 ..... N77-28420 #
NBS-SP-470 ..... N77-28545 #
NBS-SP-500-6 ..... N77-28855 #

NBS-TN-594-13 ..... N77-28946 #
NBS-TN-673 ..... N77-28262 #
NBS-TN-938 ..... N77-28339 #

NBSIR-74-500 ..... N77-28982 #
NBSIR-74-544 ..... N77-28259 #
NBSIR-75-925 ..... N77-28338 #
NBSIR-76-1135 ..... N77-28414 #
NBSIR-76-1145 ..... N77-28335 #
NBSIR-76-1152 ..... N77-28340 #
NBSIR-77-856 ..... N77-28480 #
NBSIR-77-857 ..... N77-28143*#
NBSIR-77-1213 ..... N77-28503 #
NBSIR-77-1228 ..... N77-28819 #
NBSIR-77-1232(ERDA) ..... N77-28296 #
NBSIR-77-1234 ..... N77-28250*#
NBSIR-77-1240 ..... N77-28345 #

NCAR-CT-40 ..... N77-29055 #
NCAR-CT-41 ..... N77-28707 #
NCAR-CT-42 ..... N77-29054 #
NCAR-CT-44 ..... N77-29053 #

NCSU-MAE-TR-76-1 ..... N77-28915 #

NCTRF-TR-124 ..... N77-28737 #

NCWC/DL-TR-3573 ..... N77-28509 #

NELC-TR-2022 ..... N77-28374 #
NELC-TR-2023 ..... N77-28367 #

NGS-3 ..... N77-28691 #

NGTER-331 ..... N77-28121 #

NIH-N01-HV-4-2904-3J ..... N77-28730 #

NIOSH-76/166 ..... N77-28475 #
NIOSH-76/193 ..... N77-28263 #

NJIT-NV-11 ..... N77-28532 #

NM-100-1 ..... N77-28810 #

NOAA-TM-ERL-ARL-60 ..... N77-28710 #

NOAA-TM-ERL-GLERL-10 ..... N77-28571 #

NOAA-TM-ERL-WPL-18 ..... N77-28689 #
NOAA-TM-ERL-WPL-20 ..... N77-28706 #

NOAA-TM-NOS-NGS-7 ..... N77-28688 #

NOAA-TM-NWS-CR-61 ..... N77-28712 #

NOAA-TM-NWS-WR-112 ..... N77-28705 #
NOAA-TM-NWS-WR-115 ..... N77-28711 #

NOAA-TR-ERL-366 ..... N77-28709 #
NOAA-TR-ERL-383 ..... N77-28714 #

NOAA-TR-NOS-67 ..... N77-28691 #

NOAA-77021602 ..... N77-28610 #
NOAA-77030210 ..... N77-28566 #
NOAA-77030307 ..... N77-28705 #
NOAA-77030402 ..... N77-28985 #
NOAA-77031802 ..... N77-28688 #
NOAA-77031804 ..... N77-28689 #
NOAA-77032403 ..... N77-28713 #
NOAA-77032903 ..... N77-28706 #
NOAA-77032904 ..... N77-28571 #
NOAA-77032919 ..... N77-28690 #
NOAA-77033001 ..... N77-28714 #
NOAA-77033101 ..... N77-28712 #
NOAA-77033105 ..... N77-28711 #
NOAA-77040501 ..... N77-28691 #
NOAA-77041314 ..... N77-28709 #
NOAA-77041315 ..... N77-28710 #

NPS-33JE76121 ..... N77-28913 #
NPS-53ZH77041 ..... N77-28702 #
NPS-63ES77031 ..... N77-28700 #

NPS55-77-1 ..... N77-28883 #
NPS55-77-7 ..... N77-28898 #
NPS55-77-20 ..... N77-28899 #

NRL-MR-3439 ..... N77-28949 #
NRL-MR-3442 ..... N77-28672 #
NRL-MR-3465 ..... N77-29051 #

NRL-R-8063 ..... N77-28253 #

NRL-8094 ..... N77-28944 #

NSF-MODE-CONTRIB-87 ..... N77-28697 #

NSF/PRA-7619803-1-7 ..... N77-29009 #
NSF/RA-760263 ..... N77-29025 #
NSF/RA-760395 ..... N77-28609 #
NSF/RA-760453 ..... N77-28860 #
NSF/RA-760457 ..... N77-28738 #
NSF/RA-760466 ..... N77-29015 #
NSF/RA-760476 ..... N77-29001 #
NSF/RA-760488 ..... N77-28342 #
NSF/RA-760491 ..... N77-28329 #
NSF/RA-760492 ..... N77-28343 #
NSF/RA-770017 ..... N77-28620 #
NSF/RA-770030 ..... N77-29007 #
NSF/RA-770039 ..... N77-28617 #
NSF/RA/N-73-271 ..... N77-28327 #
NSF/RA/T-74-057 ..... N77-28506 #

NSO-10 ..... N77-28847 #

NSR-5-1 ..... N77-28586*#

NSS-OC-RP012-VOL-1 ..... N77-28151*#
NSS-OC-RP012-VOL-2 ..... N77-28152*#
NSS-OC-RP012-VOL-3 ..... N77-28153*#

NSWC/DL-TR-3449 ..... N77-28536 #
NSWC/DL-TR-3535 ..... N77-28197 #
NSWC/DL-TR-3584 ..... N77-28096 #
NSWC/DL-TR-3638 ..... N77-28673 #
NSWC/WOL/TR-76-99 ..... N77-28281 #
NSWC/WOL/TR-76-144 ..... N77-28311 #

NU-SML-TR-77-1 ..... N77-28531 #

NVL-0059-003 ..... N77-28411 #

NWC-TP-5880 ..... N77-28202 #
NWC-TP-5915 ..... N77-28102 #

NYSDOT-ERD-77-RR-40 ..... N77-28538 #
NYSDOT-ERD-77-RR-41 ..... N77-28537 #

ONR-CR-213-136-1F ..... N77-28732 #
ONR-CR-213-140-1 ..... N77-28117 #

OSU-CISRC-TR-76-3 ..... N77-28813 #

OWRT-A-023-LA(3) ..... N77-28458 #
OWRT-A-030-MINN (3) ..... N77-29022 #
OWRT-A-032-LA(3) ..... N77-28458 #
OWRT-A-043-TENN(1) ..... N77-28463 #
OWRT-A-057-CONN(1) ..... N77-29005 #
OWRT-A-065-HI(1) ..... N77-28715 #
OWRT-A-088-MO(1) ..... N77-29008 #

P-385 ..... N77-28737 #

PA-TM-2222 ..... N77-28258 #

PA-TR-5026 ..... N77-28965 #

PAR-76-6-VOL-4-PT-1 ..... N77-28837 #

PAS-76-47 ..... N77-28505 #

PB-264069/6 ..... N77-28606 #
PB-264170/2 ..... N77-28321 #
PB-264649/5 ..... N77-28607 #
PB-264756/8 ..... N77-28539 #
PB-264822/8 ..... N77-28628 #
PB-264824/4 ..... N77-28724 #
PB-264829/3 ..... N77-29004 #
PB-264865/7 ..... N77-29006 #
PB-264887/1 ..... N77-29005 #
PB-264895/4 ..... N77-28537 #
PB-264908/5 ..... N77-29009 #
PB-264918/4 ..... N77-28133 #
PB-264933/3 ..... N77-28914 #
PB-264950/7 ..... N77-28739 #
PB-264953/1 ..... N77-28625 #
PB-264954/9 ..... N77-28626 #
PB-264973/9 ..... N77-28978 #
PB-264975/4 ..... N77-28725 #
PB-264981/2 ..... N77-28995 #
PB-265005/9 ..... N77-28915 #
PB-265015/8 ..... N77-29001 #
PB-265061/2 ..... N77-28504 #
PB-265096/8 ..... N77-28376 #
PB-265097/6 ..... N77-28738 #
PB-265100/8 ..... N77-29007 #
PB-265102/4 ..... N77-28503 #
PB-265110/7 ..... N77-28335 #
PB-265114/9 ..... N77-28916 #
PB-265116/4 ..... N77-28609 #
PB-265118/0 ..... N77-28860 #
PB-265119/8 ..... N77-28855 #
PB-265130/5 ..... N77-28991 #
PB-265137/0 ..... N77-28983 #
PB-265140/4 ..... N77-29015 #
PB-265149/5 ..... N77-28984 #
PB-265166/9 ..... N77-28977 #
PB-265169/3 ..... N77-28981 #
PB-265172/7 ..... N77-28715 #
PB-265173/5 ..... N77-28572 #
PB-265175/0 ..... N77-29008 #
PB-265204/8 ..... N77-28463 #
PB-265223/8 ..... N77-28458 #
PB-265246/9 ..... N77-28704 #
PB-265267/5 ..... N77-28610 #
PB-265302/0 ..... N77-28420 #
PB-265320/2 ..... N77-28484 #

PB-265324/4 ..... N77-29014 #
PB-265325/1 ..... N77-29013 #
PB-265352/5 ..... N77-28546 #
PB-265358/2 ..... N77-28538 #
PB-265361/6 ..... N77-29012 #
PB-265363/2 ..... N77-28629 #
PB-265370/7 ..... N77-28627 #
PB-265414/3 ..... N77-28566 #
PB-265455/6 ..... N77-28574 #
PB-265457/2 ..... N77-29019 #
PB-265484/6 ..... N77-28621 #
PB-265490/3 ..... N77-28616 #
PB-265551/2 ..... N77-28687 #
PB-265554/6 ..... N77-28613 #
PB-265562/9 ..... N77-28740 #
PB-265592/6 ..... N77-28631 #
PB-265593/4 ..... N77-28632 #
PB-265622/1 ..... N77-28338 #
PB-265633/8 ..... N77-28614 #
PB-265634/6 ..... N77-29020 #
PB-265636/1 ..... N77-28996 #
PB-265665/0 ..... N77-28635 #
PB-265672/6 ..... N77-28296 #
PB-265694/0 ..... N77-28982 #
PB-265706/2 ..... N77-28615 #
PB-265711/2 ..... N77-28544 #
PB-265715/3 ..... N77-28341 #
PB-265718/7 ..... N77-29011 #
PB-265719/5 ..... N77-28340 #
PB-265726/0 ..... N77-29054 #
PB-265727/8 ..... N77-28707 #
PB-265728/6 ..... N77-28730 #
PB-265731/0 ..... N77-28633 #
PB-265735/1 ..... N77-28634 #
PB-265742/7 ..... N77-29025 #
PB-265746/8 ..... N77-29018 #
PB-265753/4 ..... N77-28474 #
PB-265761/7 ..... N77-29055 #
PB-265762/5 ..... N77-28327 #
PB-265792/2 ..... N77-29017 #
PB-265798/9 ..... N77-28543 #
PB-265803/7 ..... N77-28339 #
PB-265804/5 ..... N77-29026 #
PB-265820/1 ..... N77-29053 #
PB-265838/3 ..... N77-28569 #
PB-265839/1 ..... N77-29016 #
PB-265846/6 ..... N77-28729 #
PB-265848/2 ..... N77-28573 #
PB-265873/0 ..... N77-28728 #
PB-265889/6 ..... N77-28852 #
PB-265892/0 ..... N77-28547 #
PB-265900/1 ..... N77-28506 #
PB-265904/3 ..... N77-28986 #
PB-265940/7 ..... N77-28688 #
PB-265941/5 ..... N77-28705 #
PB-265945/6 ..... N77-28851 #
PB-265950/6 ..... N77-28819 #
PB-266008/2 ..... N77-28997 #
PB-266010/8 ..... N77-28689 #
PB-266012/4 ..... N77-28985 #
PB-266013/2 ..... N77-29010 #
PB-266022/3 ..... N77-29022 #
PB-266025/6 ..... N77-28636 #
PB-266027/2 ..... N77-28421 #
PB-266039/7 ..... N77-28619 #
PB-266040/5 ..... N77-28946 #
PB-266055/3 ..... N77-28620 #
PB-266057/9 ..... N77-28618 #
PB-266072/8 ..... N77-28617 #
PB-266073/6 ..... N77-28336 #
PB-266075/1 ..... N77-28337 #
PB-266077/7 ..... N77-28545 #
PB-266087/6 ..... N77-29024 #
PB-266092/6 ..... N77-28642 #
PB-266093/4 ..... N77-28643 #
PB-266094/2 ..... N77-28640 #
PB-266103/1 ..... N77-28637 #
PB-266104/9 ..... N77-28639 #
PB-266109/8 ..... N77-28638 #
PB-266111/4 ..... N77-28328 #
PB-266127/0 ..... N77-28641 #
PB-266165/0 ..... N77-28918 #
PB-266181/7 ..... N77-29027 #
PB-266201/3 ..... N77-29021 #
PB-266217/9 ..... N77-28645 #
PB-266220/3 ..... N77-29023 #
PB-266231/0 ..... N77-28644 #
PB-266238/5 ..... N77-28345 #
PB-266257/3 ..... N77-28570 #
PB-266266/6 ..... N77-28575 #
PB-266277/3 ..... N77-28998 #
PB-266340/9 ..... N77-28708 #
PB-266353/2 ..... N77-28648 #
PB-266355/7 ..... N77-29028 #
PB-266359/9 ..... N77-29029 #
PB-266375/5 ..... N77-28649 #
PB-266414/2 ..... N77-28690 #
PB-266420/9 ..... N77-28571 #
PB-266421/7 ..... N77-28706 #
PB-266422/5 ..... N77-28713 #
PB-266425/8 ..... N77-28647 #
PB-266439/9 ..... N77-28475 #
PB-266449/8 ..... N77-28263 #
PB-266450/6 ..... N77-28646 #
PB-266569/3 ..... N77-28344 #
PB-266579/2 ..... N77-28262 #
PB-266607/1 ..... N77-28329 #
PB-266615/4 ..... N77-28970 #
PB-266648/5 ..... N77-28342 #
PB-266770/7 ..... N77-28999 #
PB-266868/9 ..... N77-28343 #
PB-266955/4 ..... N77-28709 #
PB-266956/2 ..... N77-28710 #
PB-266966/1 ..... N77-28712 #
PB-266967/9 ..... N77-28691 #
PB-266968/7 ..... N77-28711 #
PB-266990/1 ..... N77-28714 #

PDT-76-131 ..... N77-28464 #

POLY-EE/EP-76-019 ..... N77-28846 #
POLY-EE/EP-76-023 ..... N77-28839 #

POLY-M/AE-77-5 ..... N77-28534 #

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PROGRAM-HR-39 ..... N77-28851 #

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PT-67 ..... N77-28596 #

PTI-7701 ..... N77-28504 #

PTPT-77-17 ..... N77-28307 #

PWA-5490-1 ..... N77-28280 #

QPR-1 ..... N77-28418 #
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QR-1 ..... N77-28360 #
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QR-3 ..... N77-28616 #
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QR-10045-3 ..... N77-28617 #

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R-749-UILU-ENG-76-2237 ..... N77-28481 #
R-755 ..... N77-28841 #
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R-1966-ARPA ..... N77-28459 #
R-2057/1-PR-PT-1 ..... N77-28861 #
R-2057/2-PR-PT-2 ..... N77-28862 #

RADC-TR-76-224-VOL-4-PT-1 ..... N77-28837 #
RADC-TR-76-307 ..... N77-28383 #
RADC-TR-76-326-VOL-8 ..... N77-28843 #
RADC-TR-76-329-VOL-7 ..... N77-28842 #
RADC-TR-76-332 ..... N77-28694 #
RADC-TR-76-340-VOL-1 ..... N77-28833 #
RADC-TR-76-340-VOL-2 ..... N77-28834 #
RADC-TR-76-350 ..... N77-28928 #
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RADC-TR-76-377 ..... N77-28482 #
RADC-TR-76-381 ..... N77-28295 #
RADC-TR-76-401 ..... N77-28373 #
RADC-TR-76-407 ..... N77-28962 #

RADC-TR-77-11 ..... N77-28896 #
RADC-TR-77-15 ..... N77-28846 #
RADC-TR-77-25 ..... N77-28363 #
RADC-TR-77-47 ..... N77-28366 #
RADC-TR-77-49 ..... N77-28510 #
RADC-TR-77-53 ..... N77-28368 #
RADC-TR-77-70 ..... N77-28675 #
RADC-TR-77-88 ..... N77-28839 #
RADC-TR-77-103 ..... N77-28835 #

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RAE-TR-69130 ..... N77-28079 #
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RDR-1786-6 ..... N77-28292 #
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RE-CR-77-3 ..... N77-28940 #
RE-CR-77-4 ..... N77-28479 #

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REPT-76/68-T-18 ..... N77-28106 #
REPT-77-FM-32 ..... N77-28868*#
REPT-77-FM-38 ..... N77-28217*#
REPT-77-02-06 ..... N77-28796 #
REPT-88 ..... N77-28805 #
REPT-200W/KG-7-77-048 ..... N77-28580*#
REPT-512-22568-1 ..... N77-28498 #
REPT-765-5608-001 ..... N77-28409 #
REPT-0001-0789 ..... N77-28988 #
REPT-1432-1 ..... N77-28306 #
REPT-2753/981 ..... N77-28364 #
REPT-8945 ..... N77-28501 #
REPT-010588-34-F ..... N77-28743 #
REPT-014523-2-T ..... N77-28727 #

RFP-2567 ..... N77-28275 #

RIA-R-TR-77-003 ..... N77-28294 #

RL-77-8 ..... N77-28231 #

RM-627 ..... N77-28935 #
RM-628 ..... N77-28936 #
RM-630 ..... N77-28523 #

RPI-CS-77-1 ..... N77-28542 #

RR-28 ..... N77-28570 #
RR-77-02 ..... N77-28499 #
RR-77-40 ..... N77-28538 #
RR-398 ..... N77-28848 #

RRA-N7702 ..... N77-28201 #
RRA-N7704 ..... N77-28686 #

RSL-TR-291-2-VOL-1 ..... N77-28560*#
RSL-TR-291-2-VOL-2 ..... N77-28561*#

RTR-016-2 ..... N77-28214*#
RTR-016-4 ..... N77-28212*#

R74AEG452-VOL-2 ..... N77-28126 #
R74AEG452-VOL-3 ..... N77-28127 #
R77AEG482 ..... N77-28122*#

SAE-740366 ..... N77-28069*#

SAH-TR-77-1 ..... N77-28741 #

SAMSO-TR-57-VOL-3 ..... N77-28210 #
SAMSO-TR-77-57-VOL-1 ..... N77-28208 #
SAMSO-TR-77-57-VOL-2 ..... N77-28209 #
SAMSO-TR-77-72 ..... N77-28964 #

SAND-75-0147 ..... N77-28869 #
SAND-76-5758 ..... N77-28591 #
SAND-76-8056 ..... N77-28938 #

SAO-SR-377 ..... N77-28662*#

SAR-3 ..... N77-28939 #

SATR-2 ..... N77-28411 #

SCG-60518R ..... N77-28204*#

SDC-TM-5542/08/01 ..... N77-28843 #
SDC-TM-5542/007/01-VOL-7 ..... N77-28842 #

SO6-4501-7 ..... N77-28301*#

SQUID-CIT-8-PU ..... N77-28462 #

SQUID-PIB-34-PU ..... N77-28256 #

SRD-76-151 ..... N77-28317 #
SRD-77-035 ..... N77-28401 #

SRI/CRESS-17 ..... N77-29007 #

SU-SOL-76-20 ..... N77-28836 #

SU-STAN-CS-76-583 ..... N77-28871 #
SU-STAN-CS-76-584 ..... N77-28800 #

SU-TR-64 ..... N77-28882 #
SU-TR-204 ..... N77-28452 #

SUIPR-699 ..... N77-29048*#
SUIPR-700 ..... N77-29049*#

SWRI-02-4231-001 ..... N77-28540 #

S2-18 ..... N77-28179 #

TARADCOM-TR-12242 ..... N77-28880 #

TEC-77/001 ..... N77-28596 #

THEMIS-UGA-37 ..... N77-28815 #

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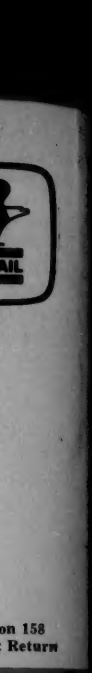

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